



Moving the Discussion Forward Through Surprises and Dilemmas: Teacher Learning in Academic Discussion

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**Moving the discussion forward through
surprises and dilemmas:
Teacher learning in academic discussion**

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**A Thesis Presented to the Faculty
of the Graduate School of Education of Harvard University
in Partial Fulfillment of the Requirements for
the Degree of Doctor of Education**

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This is for Ge.

Husbands don't get much credit for supporting their dissertating wives.

Well, let it be known then that through 22 years of friendship, love, and marriage,
Ge was always there, standing beside me, quietly.

He didn't always understand.

But he always cared.

As a result, I was forever happily surprised...

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Learners interact with the world and are guided by their teachers. Here are the teachers who shaped my scholarship and supported me in becoming a qualitative researcher.

Robert Selman showed me the importance of theory in practice and how practice builds theory. Those lessons are deeply instilled in my core of knowledge.

Catherine Snow taught me how to be rigorous in research. My methods and writing skills tripled each time she emailed me...I kid not, and some of them were only one-sentence comments!

Ethan Lowenstein guided my first experience of authentic academic discussions during afternoon rounds of coding teacher performance measures. He reminded me to listen to the teachers as well as observe them.

These were my committee members, and they shared one thing in common. They were very honest and open about the way they went about thinking and doing research. As their research assistant on two different projects, I was blessed with the opportunity to see these experts in action. What I learned from them will converge to a point in the future when I, too, will have to make significant decisions in research and practice. My ability to form good judgments, despite the uncertainties of educational research outcomes, will be indebted to the wisdom gained from learning with my committee members.

This study would not have been possible without the generous financial support in the form of a dissertation grant from the National Academy of Education (NAED)/Spencer Foundation. In addition to funding, NAED/Spencer

Foundation also introduced me to a cohort of new scholars who enthusiastically shared their work, bonded over meals, and offered collegial support. I learned so much about how scholars in other fields approached my thesis. It was an invaluable experience.

Successful data collection is a major milestone in the doctoral journey. The coaches in the *Word Generation* program were crucial in my data collection efforts and generous with their time. Claire White supported me immensely by ensuring my access to field sites and appreciation for how exciting *Word Generation* is. Thank you all.

The year we collected data, we encountered falling trees, icy snowstorms, almost speeding tickets, and numerous mishaps along the highway. Gretchen, the videographer, not only captured the fleeting moments of student and teacher actions on tape, she managed to swerve her car through obstacles to get me to our field sites *on time* and *safely*. She was the best research assistant one could ever hope to collaborate with.

My methods were borne out of a clinical teaching tradition that sought to eliminate medical errors and increase team performance. In the world of medical simulation education, Liana Kappus, Liat Gelblum Pessach, and Peter Weinstock first trained me to observe and respond to decisions under uncertainty. I am grateful for the learning opportunities the Simulator Program at Boston Children's Hospital provided me.

Writing is another painstaking milestone, one requiring the support of good friends in-between cups of latte:

Meredith Mira, the first in our writing group to graduate, was upbeat throughout the whole process and edited my various versions of dissertation proposals.

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Jennifer Dorsey is full of sense – that qualitative kind of sense-making that is at once precise, hilariously funny, a tad sad, and deeply profound. Apart from her care packages of Japanese chocolates, I appreciated how she patiently listened to me think through the confusing raw data spread over my codes.

My father, Chin Wen Hsiao, and my mother, Ying-Pu Sung Hsiao, pushed me toward achievement, but did so with much freedom. When I announced many years ago in California that I was going to pick up my bags to become a public school teacher in Boston – not quite the typical profession the Taiwanese-Chinese community aspired their daughters and sons to be - they responded: “Well, at least you are only a domestic phone call away.”

Ge Vue, arrived just a few years later to Boston, and he (not me) has been the central figure that kept our families together throughout these years. I needed my families to be intellectually productive. In the doctoral program, you sometime lose your way, and families bring you back to where you first started.

Hailey Vue, my daughter, came along many, many years later. She is the reason why I can keep seeing new things in my data. It’s cliché, but it is true. Everyday she wakes up and welcomes the world from the fresh eyes of a preschooler.

Finally, there are the teachers in my study who inspired me.

They opened their classroom doors for a doctoral student to see and hear. At first, I could only sense the good work going on but did not understand why good teaching and learning unexpectedly emerged. So, they opened their hearts and minds to share and explain their expertise and how central their students were in the work that they did.

I am a cranky, skeptic at heart so it took awhile for me to believe. But when they showed me how they grew because they saw that their students blossomed, I also developed as a researcher.

Jeff recently emailed to say hi. He has since retired from his district after his last year of implementing *Word Generation*. But Jeff is now teaching part-time at a private school and feeling comfortable with his new colleagues. He sounded utterly happy to be working with students again.

Jeff has found ways to stay excited in his teaching throughout his long career. He didn't just re-invent himself like the professionals of my generation. I learned so much just by watching his instructional moves, patient yet always curious. My generation can sometimes lack the conviction and passion that comes from sustained practice, an art that Jeff had mastered. Perhaps we give up too easily.

Jeff's story is a reminder that there is more to be unpacked from case studies of good teaching and learning. He and the other teachers in my study continue to inspire me.

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ABSTRACT

Academic discussion deepens learning when students share multiple perspectives, challenge propositions, and build on each other's ideas to develop their own understanding (Michaels, O'Connor, & Resnick, 2008; Cazden, 1988). But academic discussion is rare in practice, suggesting that teachers are not implementing effective 'talk moves,' or discussion-based strategies to foster genuine dialogues (Applebee, Langer, Nystrand, & Gamoran, 2003). How do teachers learn to respond to students effectively in academic discussion?

This dissertation aims to describe the process by which teachers learn to teach using discussion in their own classrooms after professional development. It follows six teachers implementing a new curriculum, *Word Generation*, that uses discussion and debate to deepen students' reading comprehension. Teachers were filmed conducting classroom discussions with their own students and then interviewed about their experiences, particularly how they made decisions on what to do and say in response to student contributions or events that emerged in the discussion. While developing the craft of dialogic teaching (Boyd and Markarian, 2011), teachers also encountered surprises and dilemmas, two types of teaching uncertainties that tested and influenced their professional growth.

Findings showed that teachers mastered more effective discussion teaching skills when they learned to manage or resolve their uncertainties. In fact, surprises and dilemmas were important sources of experiential learning for the teachers who used their experiences of uncertainty to see and respond

successfully to student contributions. The dissertation is comprised of two main articles. The first study analyzes the role that surprise plays in changing teacher perceptions of student abilities in academic discussion. The second is a case study exploring one teacher's teaching dilemmas, and how, in order to resolve competing instructional goals, he attained more sophisticated techniques that fostered productive student talk. These findings shed light on how professional educators can support teacher implementation of academic discussion when surprises and teaching dilemmas are addressed in professional development.

For that is the breakthrough: *His* inferences become part of *my* arsenal of facts. If ever so slowly, a picture of observed behavior, plus its attendant meanings, begin to emerge. My descriptions, my analysis, my interpretation, serve to flesh out that picture to help others not only to see but also to understand.

Confessions of a 'Trained' Observer

Harry Wolcott, 1994

You cannot simply squeeze a discussion out of students.

Although the teaching profession relies heavily on lectures and test-like questions during instruction (Applebee, Langer, Nystrand, & Gamoran, 2003; Nystrand, Wu, Gamoran, Zeister, & Long, 2003; Cuban, 1993), research has shown that academic discussion among peers is more effective in deepening student understanding and sharpening critical thinking skills (Michaels, O'Connor, & Resnick, 2008; Nystrand, 2006; Osborne, Erduran, & Simon, 2004; Cazden, 2001). Some scholars like Shulman (2000, p.132) would even argue that "theories of teaching demand principles of both exposition and discussion" because comprehensive learning requires students to be able to communicate ideas and engage others in "some form of dialogue, exchange, conversation, or alternating argument." Academic discussion - a form of discourse in which students clarify, propose, and critique different perspectives and ideas - is the model classroom talk proposed by educational researchers.

But generating a discussion among students is not an easy feat! When we filmed classrooms implementing whole group discussions, I saw first-hand the challenges of arousing one from a motley crew of wiggly middle schoolers. Behind the camera, we observed what happened when teachers gathered their students for a discussion, especially the first time we went in to videotape one:

...In Ms. Harmon's class, 19 students squirmed into a U-shaped arc. They had filed into the classroom, startled to see clusters of team desks transformed into a half-circle. One student pointed at the teacher and loudly remarked: "Hey, she's wearing a business suit! What's going on?"

The teacher sat in the middle of the arc, also shifting uncomfortably at first. She had re-arranged the classroom in an attempt to encourage student talk. The first speaker had to be solicited after students silently eyed each other around the room. Later in an interview, she would share how "it was a bit weird sitting down the whole time" trying *not* to be the "focal point" of the discussion. She wanted very much to fade out and have the students engage in a "conversation."

...In Mr. Corbett lab, the sixth graders were huddled in small teams of three, trying to identify four mysterious white powders. The camera panned the teacher leaning over the team's lab books and asking students for updates on their progress. At one point, the teacher straightened up, took a breath, and went to the videographer. He was very apologetic and polite. After reviewing student work, he became convinced his students were unprepared to hold a classroom debate. Would we like to come back the next day to film one when they were more ready?

...The students in Ms. Walter's social studies class had never participated in a fishbowl debate before. They were used to their assigned seating, carefully arranged by the teacher so that students with attention deficit disorders could

focus better. During the transition to a second round of debate, one student accidentally fell and hit her head on the floor when a classmate moved her seat closer to the center of the fishbowl. The commotion ended the debate immediately, and the teacher had to redirect flustered students back to their original seats.

These initial recordings show the predicaments that teachers face when learning to perform “dialogic teaching” (Boyd & Markarian, 2011) and orient classroom talk towards discussion. Teachers in my dissertation study tried very hard to create environments for student talk. Many went about their instruction as if kindling a small fire, seizing any opportunity they could find in students’ brief comments to ignite a full conversation for the class. However, even if discussion was planned for the lesson, there was no guarantee a successful one would develop. Teachers felt strongly that much depended on students’ motivation and ability to sustain a productive conversation. When we first began videotaping teachers, they began cautiously, unsure what middle schoolers were capable of. As Ms. Harmon reported, getting students to participate felt like “pulling teeth.” This anxiety reflects the uncertain nature of student talk. You just cannot force a discussion out of students.

Kindling a classroom discussion and using it effectively is a set of pedagogical skills that I argue lies at the core of teaching expertise. There are two facets to this complex skill. Foremost, teachers must be able to recognize in the patterns of student talk that an opportunity exists to advance student thinking.

This perspective aligns with Walshaw and Anthony's (2008) conceptualization of learning outcomes. They perceived student outcomes as contingent upon a web of inter-related school systems and classroom factors (like district policies and availability of material resources). It is not so much that teacher pedagogy *causes* a learning outcome, which in this case is a productive student discussion. Rather, the experienced teacher can spot when the classroom context gives rise to opportunities for strategized moves to carry a discussion forward.

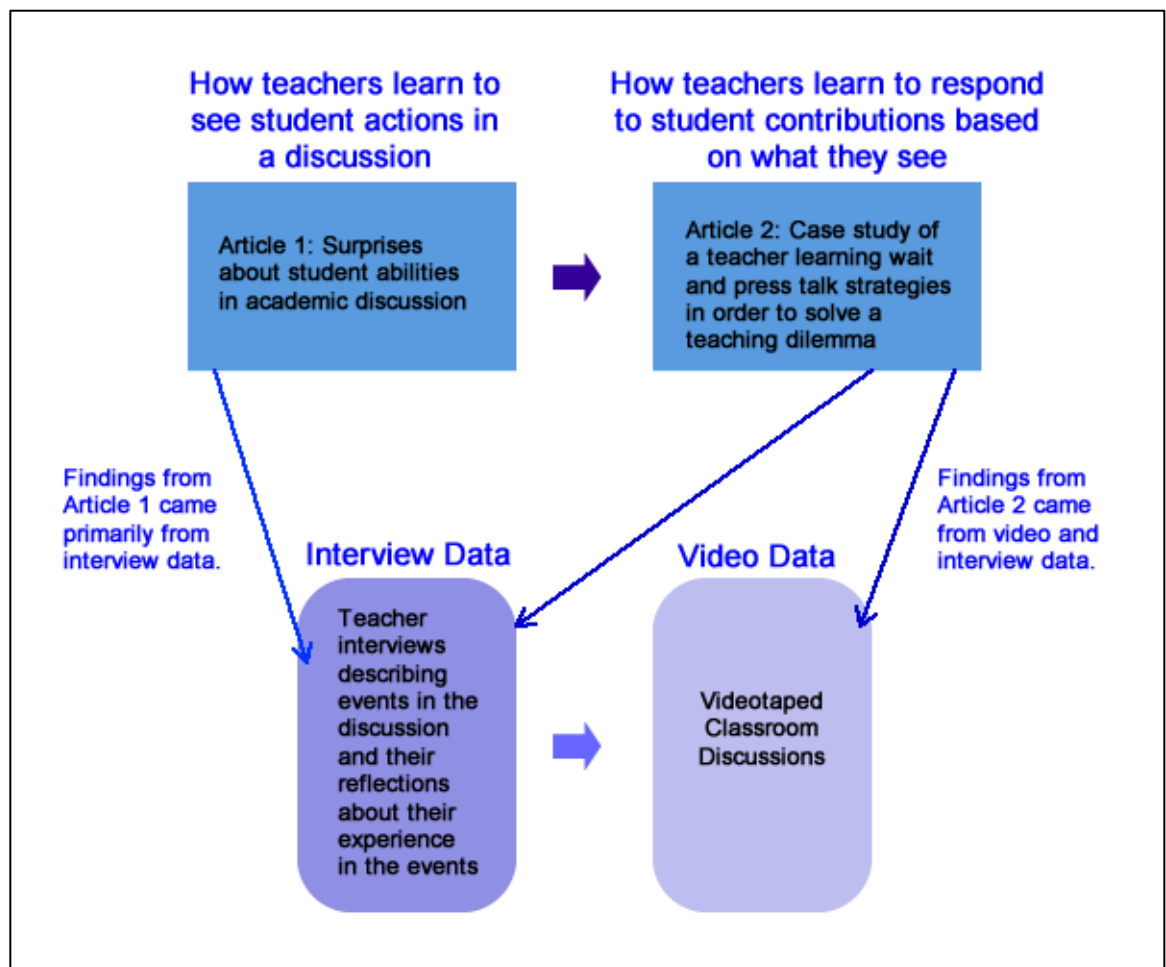
Next, teachers need to respond judiciously to student contributions and skillfully enact those very moves that can maximize student learning. Although patterns of teacher talk promoting student discussion and argumentation can be studied and learned (Osborne *et al.*, 2004), responding to students is a matter of making good instructional decisions, often under conditions of unpredictability. Unlike scripted lectures, discussion encourages students to go 'off script' to elaborate, expand, and build upon arguments with peers. There is less teacher control over how dialogues will develop, and unexpected student responses complicate instructional decisions. Yet, teachers must learn to judge and choose appropriate discursive moves. Shulman (1996, 1998) has often stated that at the heart of teaching is the ability to exercise judgment over uncertainty.

This dissertation study examines how teachers learn to respond to students effectively in academic discussion. It aims to describe the process by which teachers learn to teach using discussion in their own classrooms after professional development. My study follows a group of teachers implementing a new 'reform' curriculum that uses discussion and debate to deepen students'

reading comprehension. They were filmed conducting classroom discussions with their own students and then interviewed about their experiences, particularly how they made decisions on what to do and say in response to student contributions or classroom events that emerged. While developing the craft of dialogic instruction, teachers also encountered surprises and dilemmas, two types of teaching uncertainties that tested and influenced their professional growth. The study also explores teacher responses to their uncertainties as they mastered effective discussion teaching skills.

The dissertation is comprised of two individual articles. The first study analyzes the role that surprise plays in changing teacher perceptions of student abilities. It reports the ways teachers see and assess their students during an academic discussion. The second is a case study exploring one teacher's teaching dilemmas and how, in order to resolve competing instructional goals, he attained more sophisticated teaching techniques that fostered student talk. His story illustrates how teachers learn to respond effectively and dialogically to student thinking. Linked together, the two articles portray how teachers learn to see and then respond to student contributions in academic discussion (See Exhibit 1 on next page showing how the two articles relate to one another).

Exhibit 1: How teachers learn to see and respond in academic discussion



Intervention context: *Word Generation* and the Catalyzing Comprehension through Discussion and Debate Research Project

Before turning to the findings in each article, it is important to understand the larger intervention context in which these teachers worked and received support for developing their discussion techniques. The teachers in my dissertation were implementing *Word Generation*, a discussion-based literacy program for 4th through 8th grades. The research-based curriculum provides academic language development for middle school students, with the aim of increasing their reading comprehension of sophisticated texts across the content areas. In addition to remediation support for struggling readers, the intervention is designed to advance post-primary reading skills. Students learn to approach challenging text in different content areas by recognizing and understanding how various disciplines like science or history organize the text (Shanahan & Shanahan, 2008). They engage this text through analysis and critique of the different perspectives posed by the authors and, subsequently, attain mastery over how arguments are warranted and supported in academic language (Snow & Uccelli, 2009).

Key curricular features in *Word Generation* that target these post-primary reading skills are vocabulary and academic discussion. A unit begins with a Reader's Theater script about a controversial topic interesting to adolescent readers. Embedded in the script is a relevant set of academic vocabulary words that students encounter repeatedly across that unit of the curriculum and are encouraged to use orally in discussions. Students are invited to look at the controversial issue from many perspectives, have informal conversations about

the varied viewpoints with peers, and begin to formulate their own position. Later in the unit, they engage formally with classmates in a debate and defend their position on the issue. Finally, they write an expository essay about the issue, providing textual evidence for their claim and using the vocabulary words.

The teachers in my sample piloted extended *Word Generation* units in science and social studies. The Strategic Education Research Partnership (SERP) developed the original curriculum with the Boston Public Schools in 2007. The school-wide intervention had 72 week-long units, each focused on a particular civic dilemma, and designed to expose students to the same academic vocabulary words across English language arts, math, science, and social studies lessons. The extended versions were specifically created to strengthen content-area literacy. These newer units placed more emphasis on participation in structured discussion and debate to “catalyze” the development and integration of post-primary reading skills. Academic discussion became pivotal in teaching scientific and historical content and deepening reading comprehension. The teacher guide accompanying each extended unit offered guidance on conducting classroom discussions.

The extended *Word Generation* program was being implemented in treatment schools for the experimental research project, *Catalyzing Comprehension through Discussion and Debate* (CCDD). A five-year investigation funded by the Institute of Educational Sciences, CCDD tested to what extent the post-primary reading skills of perspective-taking, complex reasoning, and academic language can explain variations in sophisticated

reading outcomes. SERP conducted the CCDD research project in schools in four participating districts. At the time of data collection for this dissertation study, two teachers in treatment schools were implementing their second year of *Word Generation*. Four teachers came from first-year implementation schools. At the initial videotaping sessions, these four teachers had been using the program for less than two months.

CCDD provided pilot teachers many professional development opportunities. Teachers were invited to attend a four-day summer institute that gave an overview of the yearlong curriculum, the research behind the reading program, and workshops showcasing effective classroom discussion techniques. The institute was jointly led by SERP literacy coaches, CCDD researchers, curriculum designers, and teacher-mentors who were experienced discussion leaders or knowledgeable about the original *Word Generation* curriculum. Each treatment school also had access to onsite coaches who regularly met with teachers and supported implementation efforts on a weekly basis. In some schools, coaches also led professional learning community teacher meetings to discuss solutions to implementation challenges for specific grade levels.

However, despite access to professional development and rich material resources, schools adhered to varying levels of implementation fidelity and varied widely in their support for teachers learning academic discussion. Because school and teacher characteristics affect curricular implementation (Roehrig, Kruse, & Kern, 2007), Appendix A in this introduction provides brief descriptions

about each teacher's background and school site to contextualize the findings in the following two articles.

Appendix A: Teacher and school site background information

The descriptions in this appendix come from educational government agency records, coaching documentation, and my field notes. Field observations were conducted while filming classrooms and from shadowing SERP literacy coaches when I collected implementation data for the project as a CCDD graduate researcher. Pseudonyms are used to identify each teacher.

Mr. Corbett: Second-year implementation teacher in 6th grade science and math for District 1

School environment: Mr. Corbett worked at a small middle school situated along a coastal town. Although the majority of the student population were white, the school had recently enrolled a large population of immigrant and minority students whose families worked as seasonal laborers in the local tourism industry. The school was performing at the low end of state tests and was heavily invested in the *Word Generation* program. During the first year of implementation, administrators provided teachers with the flexibility of meeting weekly to work together on the program, and district officials collaborated closely with the SERP coach to scale implementation. In year two, each teacher in 6th grade taught the original *Word Generation* units and the extended science and social studies units during a class period set aside just for the literacy program. Mr. Corbett worked at a school with generally high fidelity of implementation.

Teacher background and network of support: Out of the six pilot teachers, Mr. Corbett was the most veteran educator with 37 years of teaching experience. He had a strong background in science. He strongly believed *Word Generation* was a good program that fit the needs of his small district. He worked in a supportive community of other veteran 6th grade teachers. *Word Generation's* emphasis on cross-content learning appealed to this group of faculty who were experienced with co-teaching classes together. Many of them also expressed being comfortable with holding classroom discussion although it is not clear whether they had extension experience in academic discussion. They worked together to refine and modify some of the unit activities to accommodate their grade level needs.

Professional development access: Neither Mr. Corbett nor his colleagues attended the summer institute prior to data collection. In the fall of the first implementation year, the coach and a curriculum writer provided overviews of unit activities in-house during special half-day professional development workshops. Coaching reports in the second year of implementation show that Mr. Corbett touched base with the SERP coach on a weekly basis. Toward the latter half of the school year, the SERP coach moved to another state and continued to contact Mr. Corbett and his colleagues through video conferencing and emails. Most of those interactions centered on planning and debriefing unit activities.

Ms. Walter: Second-year implementation teacher

in 6th social studies in District 2

School environment: Ms. Walter taught at a math and science pilot school in an urban district. Half of the student population were African-Americans, and 45% of the students were Hispanics. Approximately three quarters of the students were eligible for free or reduced lunch, and the school offered a special inclusion program that served about a quarter of the students. Ms. Walter's classes often included another adult in the room who was either a City Year volunteer or a paraprofessional assigned to support a student with severe learning disabilities. The school was not meeting state testing standards, and at the time of data collection, undergoing a transition. About two years prior, the district restructured and closed down a neighboring middle school. Ms. Walter's school absorbed the influx of new students and expanded its program offerings.

When *Word Generation* was being implemented, teachers were also implementing three other new academic programs. During exit interviews in June, teachers reported being overwhelmed by the number of new programs they were required to learn and implement. One 4th grade teacher shared there was "no accountability" nor pressure from school administrators to actually implement *Word Generation*, and hence, most teachers did not use it despite the SERP coach's efforts. Towards the end of second year, the principal informed SERP that the school could no longer participate in the CCDD research project in its third year. Ms. Walter worked at a school with generally low fidelity of implementation.

Teacher background and network of support: Ms. Walter was a veteran teacher in the district with 6 years of teaching experience in history. Although very few of her colleagues used *Word Generation*, she strongly believed in the program's objectives of teaching students to utilize historical textual evidence in discussion and debate. Ms. Walter was familiar with accountable talk, and her classroom was covered with posters of talk strategies to foster a climate of academic discussion. She frequently worked with the SERP coach to pilot the extended social studies units. Her school did not have a designated *Word Generation* period but she embedded the program into her social studies curriculum.

Professional development access: Ms. Walter participated as an experienced discussion teacher at the summer institute and even helped with editing some of the initial drafts of the social studies units. There were no professional learning community meetings held at the school. Coaching documentation showed that she interacted with the SERP coach at least once a month. Along with check-ins and planning, Ms. Walter was observed teaching the units by the coach and sometimes, co-taught with the coach certain classes that had a large number of ELL students.

Ms. Harmon and Ms. Jenkins - School A in District 3:***First-year implementation teachers in 6th grade***

School environment: Ms. Harmon taught science and math while Ms. Jenkins taught social studies in an urban school district where the majority of the local residents worked in the construction, food services, or social assistance industries. School A in this district had a student population of 40% White, 34% Hispanics, and 19% African-Americans. About 80% of the students were categorized as low income. Although the school was not meeting standards on statewide tests, the school had narrowed the achievement gap in recent years.

School A was supportive of *Word Generation* implementation, although many teachers did not learn about the program until late summer, right before school started. The school provided teachers with a dedicated *Word Generation* period session, and the SERP coach had success with scaling implementation at different grade levels. At the end of first year, School A could be categorized as a high fidelity implementation school.

Teacher background and network of support: Ms. Harmon had been teaching the sciences for the past 8 years and Ms. Jenkins had taught the humanities for at least 6 years. Both teachers were new to academic discussion as outlined in the curriculum. However, they were open to trying new techniques and believed that peer discussions were an important component of student learning. They worked in a collaborative faculty environment where teachers in all subjects were becoming familiarized with the literacy intervention. Ms. Harmon and Ms. Jenkins implemented the program in a very organized school

environment that was closely governed by administrators.

Professional development access: Neither teacher attended the summer institute prior to starting the program. However, they attended in-class modeling and demonstration sessions provided by SERP curriculum writers and coaches during the fall semester. The teachers met once a month in a professional learning community meeting to talk about program implementation. They also had access to a SERP coach who was also a curriculum writer for the extended social studies units. According to coaching reports, Ms. Harmon met or checked in with the SERP coach at least twice a month while Ms. Jenkins met more frequently at three times a month. About half of the interactions were teacher classroom observations and debriefing with the coach.

Mrs. Owen and Mr. Burns - School B in District 3:

First-year implementation teachers in 7th grade

School environment: Mrs. Owen, a social studies teacher, and Mr. Burns, a science teacher and sports coach, taught at School B in the same urban district as School A. School B was a smaller school with only 40 enrolled 7th graders. About 50% of the total student population were Hispanics, 25% were white, and 15% were African-Americans with 88% of the students eligible for free or reduced lunch. Like School A, the students did not meet statewide standards in testing but in 2013, students in 7th grade had significantly improved their testing scores. In the district, School B is reputed to have a positive peer climate. Students who were bullied at other schools were at times transferred to School B to have

successful educational experiences in a friendlier student community.

School B, however, had varying levels of implementation success with *Word Generation*. The upper grades embedded *Word Generation* units into their existing curriculum. In the lower grades, there were teachers who found many topics in the curriculum too controversial and openly expressed their dislike of the program. The SERP coach was able to scale implementation at some grade levels but had much difficulty getting faculty buy-in for the program in others. School B had mixed implementation results at the end of first year.

Teacher background and network of support: Mrs. Owen was a veteran teacher with 12 years of teaching experience and Mr. Burns had been teaching and coaching in the district for the past 6 years. Their colleague, an English Language Arts (ELA) teacher, coordinated the implementation of *Word Generation* for the four 7th grade teachers. Mrs. Owen and Mr. Burns co-taught the extended social studies units together. Due to the small number of 7th graders, they were able to divide the class up to allow more structured fishbowl debate settings. A substitute teacher worked with one half of the grade while they co-taught the debate sessions together during videotaping sessions.

Mrs. Owen was very comfortable with classroom discussions while Mr. Burns was experienced with coaching techniques. They often led two opposing teams of students, coaching each group how to defend their claims and switching from small group to whole group many times during a 50-minute session. They tried many versions of academic debates on camera and experimented with debate structures suggested by the curriculum even when they disliked the

suggestions.

Professional development access:

Both teachers became participants in my dissertation study in mid-March near the end of the school year. Mrs. Owen was on a pregnancy leave during the fall semester and did not know much about the program until she returned in late January. Mr. Burns used the extended science units in the fall but did not favor the curriculum. When Mrs. Owen returned, they teamed up and supported each other's implementation work.

Mrs. Owen and Mr. Burns did not attend the summer institute. Mr. Burns had opportunities to observe demonstrations of academic discussions by SERP curriculum writers. Coaching documentation recorded that both teachers had check-ins or were observed by the SERP coach on a weekly basis. The faculty did not meet for professional learning community meetings although the ELA teacher coordinated resources and communicated with SERP about implementation needs.

**Learning to see:
Teacher surprises
in academic discussion**

I anticipated incorrectly. I thought they were not going to have as much success as they had. But they surprised me...I said, so let's see what they have. Now you're saying no. You're saying yes - but can you *expand* upon it? What did you find? And that's where I got my nice surprise. They had made a connection on two of the four problems! They made better progress than I had thought.

Science teacher Mr. Corbett explaining why student responses surprised him during a class discussion.

Surprise plays a role in changing teacher perceptions about student learning and instruction. When teachers experience unexpected events with their own students, they stop to reexamine what is happening in the classroom. Tomkins (1962) claims surprise momentarily 'resets' the mind so that attention can shift to unusual features of the environment. In a surprise, teachers pay attention to aspects of student learning they had overlooked, and reassessments of the learning situation can motivate teachers to make alternate instructional decisions. Surprise can even prompt teachers like Mr. Corbett to reconsider their initial assumptions of what students can or cannot do.

In classrooms where reform curriculum is being implemented, teacher surprises can show us how new curricula may affect teacher perceptions. My study investigates teachers who are learning to conduct academic discussion using a discussion-based literacy intervention. Their surprises emerge from unanticipated student responses in classroom talk. Teachers notice changes in the way students talk about and demonstrate what they know. Their observations capture how academic discussion influence student learning, and in return, these assessments affect their beliefs about student abilities and dispositions towards

academic discussion.

This perceptual shift is important to understand because research examining classroom talk finds academic discussion rare in practice (Applebee, Langer, Nystrand, & Gamoran, 2003; Nystrand, Wu, Gamoran, Zeister, & Long, 2003). Most teachers follow a traditional classroom discourse known as recitation (Nystrand, 2006). It begins with teacher talk 'testing' student speakers who 'recite' back answers and ends with a teacher evaluation of the responses (Mehan, 1979). Correct answers allow teachers to further expand information about the topic. Wrong answers are dismissed as teachers move from one student to the next. Because teachers strictly control turn-taking, students seldom initiate exchanges or interact with each other. In recitation, teacher talk moves in one direction.

Contrarily, academic discussion opens up classroom talk for more unscripted exchanges between teachers and students. At the beginning of the year, teachers introduce and scaffold routines for participating in whole class and small group discussions. They model classroom talk oriented towards presenting, debating, and building ideas from complex information. Students are encouraged to elaborate on why they agree or disagree about an issue or how they came up with their solutions to a problem. Listeners learn to focus on what type of evidence speakers provide in explaining or justifying a claim. Teachers monitor and move the discussion forward by connecting different speakers' propositions. They ask open-ended questions to prompt student elaborations and structure activities to foster more interactions between students.

Emphasized in the Common Core Standards, academic discussion has the aim of developing student thinking and knowledge through participation in classroom talk. It builds epistemic understanding of how evidence validates and extends disciplinary knowledge (Osborne, Erduran, & Simon, 2004), pushing students to go beyond 'just the facts' toward deliberation of issues at stake (Michaels, O'Connor, & Resnick, 2008). Shulman (2000) considered this form of classroom talk a prevention against "illusionary understanding," the predicament of students appearing to know something when they only have surface-level understandings about a concept or skill. It is through dialogue with others that students become more aware of their misconceptions, and teachers can see past appearances of student knowing. Both students and teachers work towards engaging one another through critical, challenging questions.

However, Shulman (2000) cautioned discussion intensifies complexity and unpredictability in learning and teaching. To overcome illusionary understanding, teachers must first draw out the intuitive, misconstrued theories students hold inside their heads (Posner, Strike, Hewson, & Gertzog, 1982). In a discussion setting, they must manage this challenge with a classroom full of children. Under these circumstances, academic discussion is difficult to implement, causing some teachers slip back to recitation even when using curriculum designed to foster discussion (Alozie, Moje, & Krajcik, 2010; Christoph & Nystrand, 2001).

In this study, teachers reported being surprised when they tried using academic discussion. If surprises can show change in teacher perceptions about student learning and those changes influence teacher beliefs about how students

learn, then knowledge of what surprised teachers can greatly inform implementation research. Surprises can explain teachers' meaning-making process during instruction, and this knowledge can broaden our understanding of teachers' initial process into learning new instructional strategies, ones advanced by the reform curriculum. This study pursues this research objective by examining what surprised teachers when they implemented a discussion-based curriculum for middle school science and social studies classrooms.

Two Conceptions of Surprise

The idea that surprise plays a role in developing teaching expertise is rooted in two traditions. Philosophers since Aristotle have regarded the emotion as serving important adaptive functions because surprise shifts perception (Reisenzein, 2000; Desai, 1939). Surprise is a feeling of astonishment provoked by an unexpected event. Whether experienced adversely with intensity or pleasantly at ease, the aroused emotion halts ongoing activities to refocus one's attention on something new and unanticipated. Darwin (1872) considered the emotion a survival mechanism for spurring fight-or-flight responses to predators. He noted how surprise, often accompanied by an increased heart rate and a widening of the eyes, enhanced the ability to detect unfamiliar and potentially dangerous stimuli in the environment. From an evolutionary standpoint, this rapid shift in attention helps condition behavior.

But more than just a startled, physiological reaction to something unexpected (Ekman, Friesen, & Simons, 1985), surprise, and its relation to expectancy, implicates cognitive development. For the emotion to be genuinely incited, one has to anticipate something familiar and be 'surprised' when that anticipation is countered. In the Piagetian tradition, the presence of anticipation marks pre-existing mental schemes, and the responses toward its impediment are potential signals of "cognitive restructuring." To illustrate, Charlesworth (1969, p. 263) recounted Piaget's story of an infant's first encounter with rattles

overhanging a crib. Connected to the rattle by a string wrapped around his wrist, the baby discovered that flailing his arms unexpectedly produced lovely sounds from the rattles. He is surprised by this new sensation and pulls the string repeatedly until the rattles are under his control, a sign that he has “accommodated to and assimilated the surprising situation.” Piaget viewed this accommodation as a type of subject-environment interaction that resulted in changes in the infant’s existing schemata.

Charlesworth (1969, p. 283) highlighted how surprise instigated this change. The re-orientation to the unfamiliar pleasant sounds introduced new information about the string and encouraged its exploration. Pre-existing “stored information” of what would happen if the infant flailed his arms collide with the new information, changing how the infant interacts with and understands about the world. Through “derivatives of physical actions upon physical objects,” his direct explorations with concrete objects teach him the laws of physical phenomena. Yet the experience also changes him emotionally. He develops a “heightening sensitivity” to patterns of information deviating from his inner “logical system that sets limits to his thought.” If this system fails to appropriate salient information that surprised him, the cognitive structures must expand and modify. Charlesworth contended that, when surprising information cannot be assimilated nor ignored, adult learners similarly accommodate new information by “restructuring the old information.”

Echoing these two historical perspectives, teacher surprises are indicators of developmental growth in teachers’ understandings of instructional practice,

especially in situations where teachers are implementing reform curriculum. In such cases, teachers may feel uncertain about the new approach to student learning when the newer strategy conflicts with their pre-existing beliefs and knowledge about pedagogy. But in trying out curricular lessons, events unlike normal classroom routines can emerge, catching teachers by surprise. This surprise is a lens that captures initial shifts in what teacher notice. Their descriptions of what surprised them in their own classrooms, their explanations for what happened, and the subsequent reasons for their instructional responses illuminate how they are making meaning of this perceptual shift. In cases where teachers talk about why student actions in a new lesson activity surprised them, we can explore how they learn and develop new instructional practice during implementation of curricular reforms.

Two branches of research continue this line of exploration. The first studies how experts and novices differ in what they see. The second concerns the way professionals learn on-the-job. Conjointly, the fields of expertise development and experiential learning explain how instructional behaviors and teacher beliefs can change when surprise prompts a second look at what works in classroom learning.

Skilled Perception: Noticing What to Attend

Studies of human performance have focused on experts' perceptual skills and their ability to recognize patterns invisible to untrained eyes. Compared to novices, experts were much better at appraising situations in their practice and

using this assessment to solve problem tasks (Alexander, Murphy, & Kulikowich, 2009). DeGroot (1965) discovered champion chess players were more agile with pinpointing particular configurations that strategically established viable move options. Replication studies in chess (Connors, Burns, & Campitelli, 2011) and in other specialized domains like medicine continually show experts using pattern recognition to make judgments on what to do (Ericsson, Charness, Feltovich, & Hoffman, 2006; Johnson, 1988).

These identified patterns are deeply situated in specialized knowledge. When assessing a novel situation, experts recognize the underlying structure of problems and ignore surface details irrelevant to the problem tasks (Bransford, Brown, & Cocking, 2000). As they sort through what they see, experts apply their reasoning skills to form patterns of information around central concepts in their domain of expertise. Overtime, they build up "episodic knowledge" to help them interpret similar patterns across differing contexts (Berliner, 1988). At optimal performance level, experts have robust situational awareness. They notice around them what is important to know. Experts also infer from this noticing, what might happen in the near future that could further or hinder the goals at hand and make decisions based on their interpretations (Endsley, 2000).

Similarly, what teachers notice influences how they teach. Sherin, Jacobs, and Phillip (2011) define teacher noticing as the skillful process of paying attention to specific things and making interpretations about what is noticed. In a given moment during a lesson, many activities are happening inside a classroom. To manage the complex environment, teachers pick out distinct details from a

sea of “sensory data.” What teachers attend to and what they ignore, and the durations of their attention influence student learning outcomes. Teachers respond to what they see is happening, and these responses in turn shape instructional events. Whether the new instruction promotes or hampers student learning depends on teachers’ skilled perception, their ability to interpret learning situations well and appropriate strategies that are a good fit to the perceived learning difficulties.

Because skilled perception is learned, there is evidence suggesting experience alone cannot establish the teaching knowledge base of what to notice and how to interpret (Jacobs, Lamb, Philipp, & Schappelle, 2011). In the “real-time performance of teaching,” Erickson (2011) observed that veteran teachers tend to notice only those details they think they needed to take action on. Through successive “quick-scans,” they triage their classroom attention to plan ahead a response. But in being “tactically opportunistic” with their attention, they must assume what they see is “really there.” This habitual noticing becomes problematic when attention slips away from what is happening to what experience has taught normally happens. Such pre-existing schemas could inadvertently cause an “expert blind spot” (Nathan & Petrosino, 2003).

Surprises can unshield blinded areas of expertise. In mapping the boundaries of professional intuition, Kahneman and Klein (2009) describe how experts approach their environments searching for familiar cues on how to respond. But when they detect “violations” to expected patterns of information, the surprising circumstance stop their typical responses. Kahneman and Klein

propose that true experts “know when they don’t know” (p. 524) and are less subjected to overconfidence in their judgments due to their sensitivity to pattern anomalies.

As Kahneman and Klein (2009) cautioned, experts do fail and make choices that are “sometimes flawed.” However, surprises could bring experienced teachers back to “marvelous” choices, if pattern anomalies lead to alternative insights into student learning. Erickson (2011) found that veteran teachers use narrative understanding to “put together” what they see and experience “into a coherent interpretive picture.” Teachers make sense of what they learn from experience through recounting and deliberating about the causes of classroom events and consequences of particular instructional actions. Not only can surprises shift attention to unusual patterns in the classroom, reflecting about surprises could alter understanding of how students think.

Experiential Learning: Making Sense of Surprises

In the experiential tradition, reflection is the central practice that cultivates the skill of learning from concrete experiences. Experiential learning stems from the intellectual works of educational theorists like Dewey and Kolb (Boud, Keogh, & Walker, 2013). Dewey defined two types of experiences in the process of learning (Miettinen, 2000; Dewey, 1925). The primary experience are the sensory interactions learners have with the physical and social world, while the secondary experience externalizes the material environment and events into objects for reflection. Ordinarily, people make sense of the primary experiences easily and

respond to them using established routines. However, when the primary experience and routines 'fail' to produce expected outcomes, the crisis generates reflective thoughts on what went wrong and how to ensure better results in the future. Dewey reasoned that this secondary experience of reflection would be an impetus towards behavioral change and intellectual development.

Correspondingly, Kolb's (2001) model of learning considers how experience can be transformed into concepts that guide future decisions and choices. His model is structured within two "dialectically related modes of grasping experience - concrete experiences and abstract conceptualization" (p. 228). In Kolb's four-stage learning cycle, immediate experiences are observed, deliberated, and actively experimented upon to be "distilled" into abstract concepts. These abstract concepts become ideas that are continuously revised and tinkered with, through a cycle of reflected-upon experiences. The ideas, tested and refined, create new knowledge that suggests alternative actions.

These models of learning posit that development occurs only after experiences have been skillfully abstracted into a "principle" to guide performance. In teaching, Shulman (1996) equated this reflective process to Dewey's concept of inquiry. Teachers often begin their lessons with an intention in mind and plan classroom activities accordingly to carry out curricular intentions. However, teaching is a profession characterized by "uncertainty and unpredictability." Plans are often "interrupted by a surprise" (p. 56). For instance, students may respond differently to what teachers anticipated or peer dynamics cause lessons to unfold in unexpected ways. Shulman viewed the interference of

teaching plans as opportunities for "reflection, thought, and deliberation." The failure to accomplish goals forces an examination of what happened. Teachers who examine "the consequences of action taken in light of judgment" could reflect on what worked, what didn't, and why certain student outcomes occurred.

Shulman (1996, p. 480) said that at "the heart of teaching is developing the capacity to respond to the unpredictable." He viewed the development of judgment as the basis for navigating successfully the uncertainties of teaching. Applying "theories" of teaching and learning to the "gritty particularities of situated practice" required sound judgments on what to see and how to respond, especially when plans are surprisingly disrupted (p. 519). To expand capacity in making reliable judgments, Shulman also advocated for reflective practice in teacher professional growth.

Schon (1983, p. 56) stated this type of reflection attends to the "outcomes of action, the action itself, and the intuitive knowing implicit in the action." The focus is on both teacher perception and responses because what teachers perceived generated specific instructional actions. This perspective takes into account tacit knowledge (Polyani, 1967). The reflection not only draws out principles of what worked and didn't work in instruction, it also reveals the implicit knowledge and assumptions that teachers may have had about the teaching context. In this way, teachers become more aware of their own judgments, and this new awareness can further guide future instructional decisions. It can also ignite a change in teacher beliefs about student learning and effective pedagogy.

Surprise after Implementation: Changing Practice Before Beliefs

Through experience, teachers develop beliefs regarding which instructional actions and behaviors lead to desirable student learning outcomes. Two types of beliefs are closely linked to teacher behaviors (Bandura, 1971). Self-efficacy is how much teachers believe they have the requisite skills to teach well and foster student growth. Outcome expectancy is the degree to which teachers perceive students are capable of learning and being taught in light of external pressures such as school context, diverse backgrounds, etc. Teacher efficacy beliefs are thought to explain the varying motivation levels and kinds of instructional behaviors exhibited among teachers, particularly those learning new curricula and strategies. The higher the outcome expectancy and self-efficacy levels, the more likely teachers would persist in improving student achievement, believing that they have knowledge of and ability to alter student learning outcomes (Riggs & Enochs, 1990).

Outcome expectancy beliefs are often sought as reasons for why curriculum is implemented, ignored, or modified (Pajares, 1992). This literature suggests that teacher perceptions of student abilities greatly impacts their choice of instruction. In a case study comparing two teachers' use of a discovery-oriented science curricula, Cronin-Jones (1991) noted how both teachers believed middle school students needed a great deal of direction. The two teachers claimed that students were not capable at their age to learn on their own without a strong foundation in content knowledge and explicit directions on what to do in classroom activities. Consequently, they both modified the lessons

intended to be student-oriented into teacher-directed instruction.

Pimentel and McNeill (2013) also examined the effect of outcome expectancy beliefs on teachers' continued authoritative stance in classroom discussions. They tracked five secondary science teachers' implementation of an ecology unit designed to engage students in whole class discussions. Despite teachers reporting that instructor-driven dialogues were not ideal for student learning, analysis of all videotaped discussions found student contributions were mainly constricted to simple, short responses in teacher-to-student exchanges. Teachers offered various reasons for their instructional decisions, including their perceptions of student limitations. They thought discussions were hindered due to students' limited content knowledge about the subject and their unfamiliarity with rigorous science talk. They also perceived an overall lack of motivation among students to engage in a style of instruction that required more effort. One teacher sensed discomfort from her brightest students who feared being publicly wrong when asked to provide more complex answers. Teacher perceptions of student limitations influence the extent to which teachers are willing to implement reform curricula and make changes to their instructional practice.

However, surprises at what students can do develop teachers' understanding of new curriculum and change their beliefs about effective classroom practices. Franke, Carpenter, Fennema, Ansell, and Behrend (1998) documented case studies of teacher change in a professional development program designed to engage teachers in systematic inquiry about their students' mathematical thinking. Over a four-year period, they followed a sample of

teachers learning to implement Cognitively Guided Instruction (CGI), pedagogical strategies that utilized children's intuitive understandings to deepen numerical knowledge. In year one, third grade teacher Ms. Nathan did not believe CGI could achieve math learning objectives for her class because her students needed explicit instruction to learn arithmetic. But in year two, Ms. Nathan tried posing a few CGI multiplication word problems early in the school year before formal operations were taught. She allowed the class to solve the problems any way they wished. To her surprise, the children were able to use their own strategies to figure out the solutions, and the types of strategies they used "fit" with what she was learning in professional development about how students develop mathematical understanding.

This surprising episode initiated a change in Ms. Nathan's practice. By year four, her math lessons looked different from year one. She intervened less, permitting her students to talk about and seek their own strategies in math. Although the researchers could not ascertain whether the teacher would sustain her systematic inquiry skills overtime, Ms. Nathan experienced a dramatic change in her practice during the duration of the CGI program. This development began with the surprise about what students could do.

Contrary to dominant theories of teacher change, Guskey (2002) argued that changes in teacher beliefs follows, rather than precedes, modifications in curriculum and instruction. Beliefs are difficult to change unless evidence challenges prevailing assumptions (Pajares, 1992). The defining factor in Guskey's model is evidence of improved student learning that teachers witness

in their own classrooms after experimenting with new techniques. Teachers assess not only for academic achievement gains but also improvements in student engagement, dispositions, and behavior. It is the experience of producing a successful outcome with their own students that powerfully shapes teacher beliefs and attitudes. This is especially relevant for veteran teachers who reportedly are more likely to change practices before beliefs (Luft, 2001). Guskey's model of change is based on the premise that teachers learn through a developmental and experiential process.

Context of Study

This study was conducted during the implementation of *Word Generation*, a middle school literacy program (Snow, Lawrence, & White, 2009). The program is designed to increase student ability to comprehend sophisticated texts through vocabulary learning and academic discussion. Units begin with challenging reading materials and vocabulary words related to an issue that students would talk about throughout the program activities. Every unit includes a formal academic discussion in which students present and argue for their claims.

The three science and three social studies teachers recruited were pilot teachers working in schools participating in an experimental research study investigating the effects of the *Word Generation* program (U.S. Department of Education, Institute of Educational Sciences [IES], 2010). They were recommended by coaches as teachers who agreed to be filmed for research and were using the program on a regular basis with 6th or 7th graders. Four teachers were piloting the curriculum for the first time while two were in their second year of program implementation. All were veteran teachers with at least six years of teaching experience at their districts.

Teachers are referenced by their pseudonyms in this study. Ms. Walter taught social studies at an inner-city school comprised largely of African-American students. Mr. Corbett was the math and science instructor in a small district serving a large community of seasonal, transient laborers. The remaining four teachers worked in the same urban school district where 70% of the student

population were eligible for free or reduced lunch. The two treatment schools in this district provided their teachers with an additional class period during the day to teach the *Word Generation* curriculum. At School A, Ms. Harmon taught math and science while Ms. Jenkins taught social studies. At School B, Ms. Owen and Mr. Burns combined their 7th grade classes to co-teach the *Word Generation* social studies program. See *Appendix A* for information related to teacher and school characteristics.

Teachers had access to professional development throughout the year and one teacher attended a weeklong summer institute prior to this study. Each teacher was partnered with a coach who supported in-class modeling and led grade-level meetings to discuss program implementation. At their initial interview, all teachers reported using some type of class discussion in their regular classes. However, the academic discussion structured in *Word Generation* was fairly new to them and introduced variations of classroom discussion that teachers had not tried before, such as having students make an argument from someone else's perspective. Coaches encouraged teachers to explore these alternative formats in the curriculum.

Study Design

Because this study investigates teacher reflections on their own classroom discussions, the two types of data collected were video recordings of teachers implementing academic discussions and interviews about their experiences conducting those classroom sessions.

Video Recordings

From December 2012 to June 2013, classroom discussions were recorded through a handheld video camera and four digital tape recorders. There were many variations of discussions filmed, including whole class conversations, fishbowl debates, small team discussions, and pair-share involving two students talking to one another. Duration of discussions also varied. Some took an entire 50-minute class period while others happened during the last 20 minutes of class. Regardless of the differences, all discussions focused on students using text-based evidence to propose a claim and conversing with peers about their proposals.

Five teachers were filmed at least three times during the school year. Because Mrs. Owen and Mr. Burns co-taught, they were videotaped leading academic discussions together. Of the six teachers, Ms. Jenkins discontinued the study after the first interview, stating that she was not comfortable being videotaped by researchers. A total of 16 video recordings were collected in this sample.

Shortly after filming, segments of the discussion video were marked on a media viewer in preparation for showing them to teachers during the interview. In all recordings, clips representing the beginning, the middle, and the end were highlighted. Additionally, in some videos, there were scenes where the teacher looked surprised, and those were also marked for possible viewing.

Reflective Interviews

Teachers were interviewed using their videotaped discussions as a guide. Initially, researcher-marked segments of the videos were shared, and teachers were asked to explain what is happening at that point in the discussion. They were prompted to describe concretely what they saw the students and themselves do and say in the video. Then they shared what they recalled noticing at the time and what they thought about the student responses. This 'think aloud reflection' protocol is analogous to the stimulated recall procedures common in researching how teachers make decisions in naturalistic contexts (Lyle, 2003). This kind of protocol supports reflection because recall is stimulated through videos of teachers' own practice (Sherin & van Es, 2005).

During the recall, teachers were invited to reflect on how they made sense of the marked event. It was at this point that some teachers shared they were surprised or they found what is happening unexpected given what they planned or were expecting in the day's lessons. Teachers were also encouraged to talk about 'events' in the discussion that caught their attention, ones that were not originally marked by the researcher but were salient in teachers' memory. When teachers mentioned these events, the researcher would search for the event in the media viewer, watch it with the teacher, and hear why the teacher thought the event was important. It was during these moments that teachers also reported their surprises. Sometimes, they recalled being surprised in the actual discussion while at other times, they were surprised in the interview and highlighted unexpected student actions in the video. Finally, at the end of every interview,

teachers were routinely asked if anything surprised them about the discussion. Teacher descriptions of surprise were either prompted by interview questions or brought up independently by the teacher.

A total of 20 reflection interviews were collected across six teachers from December to June with each semi-structured interview lasting between 30-60 minutes. Ms. Owen and Mr. Burns were interviewed separately using the same videotaped recording of their jointly led discussions. Fifteen interviews (75%) were conducted within one week of the original day of filming. In the remaining 5 cases, interviews did not immediately occur due to unforeseen scheduling conflicts. These 'extra' filmed sessions were shared in a final interview in June where teachers reflected upon a sequence of video recordings representing discussions throughout the academic year.

Data Analysis

Interview transcripts were transcribed and mapped onto *dedoose*, a qualitative analytical software. A three-tiered thematic coding analysis was conducted and at each tier, data-driven codes (Boyatzis, 1998) were developed to understand the effect of surprise on teachers.

At *tier one*, all interview transcripts were filtered for incidences of surprise or unexpected events. Teacher reports of being surprised by a discussion 'event' were extracted from the transcripts. Sometimes, the interviewer asked after a teacher described an event whether he or she was surprised, and the teacher stated 'yes.' Other times, the teacher independently reported: "I was surprised."

Additionally, using theory-driven definitions of surprise (Boyatzis, 1998), events were also extracted when teachers described an occurrence as “unexpected,” “unanticipated,” or “usually doesn’t happen.” Appendix B displays the number of surprise events extracted from transcripts for each teacher. The extracted events were coded as either ‘surprise or ‘unexpected,’ labeled, and compiled into a database. The accompanying video segments related to each surprise were also transcribed and placed in the database.

At *tier two*, analytical memos were written to compare the teacher’s description of what happened with the accompanying video transcript segments. The primary source of data analysis came from the interview transcripts. The video segments were used to better understand what teachers were seeing and describing in their reports. From these memos, categories were created to describe what surprised teachers. Comparing across teacher cases, these categories were iteratively developed to identify common themes among surprises. Examples of common themes included being surprised by outside disturbances or finding student responses about a topic unexpected. These themes were developed into codes. All interview segments in the database were then coded with the Tier 2 coding scheme (See Appendix C for Tier 2 code descriptions). Most of the transcripts were surprises about student abilities.

At *tier three*, all coded segments about student performance were further analyzed. In their reflections, teachers often described what would typically happen in their regular classrooms and what unexpectedly happened in the academic discussions. These two contrasting images were summarized in the

database, and categories for why student performance surprised teachers were developed. Again, categories were compared across teacher cases to refine the tier three coding scheme (See Appendix D for Tier 3 code descriptions). In their descriptions, teachers also shared whether the surprises were positive or negative experiences. A plus or minus sign was appended to each student performance segment to represent whether teachers found the experience delightful or disappointing.

What surprised veteran teachers when they conducted academic discussions? Teachers were mostly perplexed by what their students could or could not do in a discussion setting. Differences in teacher perceptions of student abilities accounted for 70% of the surprises experienced by teachers (See *Appendix E for frequency counts of Tier 2 coded interview segments*). In 15 instances, teachers were delighted to see their students exhibit abilities that challenged their own assumptions of what middle schoolers were capable of learning and doing in academic discussion. At the same time, teachers also encountered unanticipated disappointments. In 6 cases, teachers were frustrated when students failed to carry out tasks that they expected them to easily accomplish.

In their reports, teachers often pointed out unusual student actions or behaviors in the video that contrasted from what is typically seen or heard in everyday lessons. Teachers explained how their expectations of what students can or cannot do were based on prior assessments of student abilities in traditional classroom activities. They were surprised when student interactions in the discussion countered familiar patterns of classroom behaviors. They used patterns of typical interactions as a baseline for measuring student development and concluded that the contrasts indicated growth in knowledge, skills, and attitudes in science and social studies. As a result, some teachers began to reconsider how middle schoolers participate, problem-solve, and engage in

academic discussions. But in cases where teachers perceived students to be demonstrating weak abilities or lack of understanding, teachers were perturbed, wondering what went wrong with their initial assessments. Whether delighted or disappointed, surprises show teachers were primarily concerned with evaluations of student learning.

Delightful surprises: What students can do

Teachers reported being amazed by what their students were capable of achieving or willing to do in a discussion. They excitedly talked about the unanticipated new patterns of student interactions in the video from various assessment perspectives. They were thrilled about individual accomplishments, honing in on particular learning needs and why certain responses were indicators of personal achievement. When they listened to student talk in small groups, they narrated how they thought students were framing a task and why the peer-to-peer dynamics supported the problem-solving process. In whole class discussions, they explained why the variety of feedback from different groups of students affirmed that the class overall grasped a specific concept. Teachers perceived student interactions at individual, small group, and class levels as demonstrations of student performance. Academic discussions provided an alternative context for teachers to assess how students integrated academic and social skills in a deliberation with peers, dimensions of student performance rarely exhibited in other curricular activities. The following themes explicate the kinds of performances teachers observed:

Attending to the Conversation: Participation Skills

Teachers talked frequently about student participation, a theme that emerged in more than half of the delightful surprises (9 out of 15). Foremost, teachers noticed individual students' atypical verbal behaviors, particularly among students with language and/or speech-related disabilities. In several inclusive classrooms, students with special needs took Word Generation with their general education classmates. When they volunteered a perspective in the discussion, teachers tried to help them articulate their ideas with clarity because in other classes, they often struggled to express themselves. But occasionally they needed no additional prompting to communicate their ideas.

Mr. Corbett called it a "happy surprise" when Kit who was "on the autistic spectrum" shared his idea for conducting a fair test in science. The class was discussing what test could best determine how well different types of straw flyers could travel. Mr. Corbett noted that Kit, who transferred to his school in March, required extensive accommodations in lesson activities according to his Individualized Education Plan (IEP). But in late April, Kit was filmed stating that the class should test a straw flyer "multiple times" as one condition of a fair test. Although he expressed his thought in short phrases, Mr. Corbett was thrilled because Kit hardly ever spoke up in class and "usually doesn't communicate that clearly."

Additionally, teachers were excited to hear students with special needs spontaneously use Word Generation "target words" since increasing vocabulary is a curricular objective. For example, when Ms. Harmon's class compared the

strengths and limitations of scientific models, Mateo began the discussion by explaining how models can represent the physical world. Ms. Harmon took quick notice of Mateo's choice of words to "jumpstart" the discussion:

The other thing I noticed is his use of the word, 'simulate.' So I'm already hearing them use words that they *never* would have used before. I do remember thinking: Wow, he just used that word. Yeah, and he's a student [that] just came off with an IEP. He has speech issues [and] to hear him was awesome.

Ms. Harmon specified that 'simulate' was a target word and hearing Mateo use it effortlessly in his talk demonstrated his expanding vocabulary knowledge.

General education students also exhibited unexpected participatory behaviors. In Mrs. Owen and Mr. Burns' social studies session, small groups were debating the entertainment value of gladiator games in Ancient Rome.

When asked to recall if anything surprised her while she listened in to the group conversations, Mrs. Owen pointed to a boy on the screen and exclaimed:

I'm just impressed how Miguel doesn't say boo like in the bigger class. He just doesn't say boo - I see him so engaged. It's just nice. Because you know he's getting it. He's one of those students who will putter along and do it and you know he's getting it based on assessments. But he doesn't speak up in the larger class setting. So it's interesting to see in that small group, he's really talking.

Mrs. Owen described Miguel as a reticent boy who normally would not voice his thoughts in a large class setting. She speculated Miguel and other shy learners like him were more willing to participate in smaller groupings.

While teachers noted how unusual it was to hear particular students speak up in academic discussions, they were even more astonished to find middle schoolers being attentive listeners. In the first videotaping, social studies teacher

Ms. Walter expressed concerns over fishbowl debates in the curriculum. The fishbowl structure required most of her class to sit in an outer-circle and take observational notes on a debate performed by four inner-circle speakers representing different teams. Ms. Walter's inner-city students regularly conducted discussions but they shared and challenged each other's assertions in a whole class setting. When students contributed, Ms. Walter tallied on a whiteboard the number of times each student spoke to monitor participation and this encouraged new voices. She was unsure whether students sitting in the outer circle would attend to their roles as note-takers. Her class had several students with special needs who were easily distracted, and she feared the rest of the students would be disengaged if attention only focused on four students. However, she discovered after one round of fishbowl that students in the outer-circle had insightful comments to share. For instance, Latisha praised the speakers for building their arguments in response to each other's assertions. Ms. Walter reflected:

I thought it was good observation. I was like yeah that's true. They weren't just saying whatever they wrote down. They were actually listening to each other. And if they're able to build on each other's arguments, I think that's a good thing – a good skill. They're not just saying things in a vacuum. They're saying things that are connected to what each other [said].

Ms. Walter was rather stunned because Latisha's comment along with several others' indicated that students in the outer-circle were paying attention.

Finally, a few teachers confessed feeling relieved with the participatory outcomes, such as Ms. Harmon who confessed having been initially worried that the first videotaped discussion would feel like "pulling teeth." She wasn't sure if

her students would talk much about a physics unit examining skateboard accidents. Instead, she was pleased the discussion surprisingly “flowed” with a “clear purpose” that brought together scientific talk about the results of a lab activity and students’ personal stories and experiences with skateboarding:

It didn’t jump all over the place. It started with the claim statement and the evidence. Why people’s were different – getting into that reason - scientific reasons of why things were so different. And then kind of bring it to the social aspect and the real life. So I think it flowed well.

To Ms. Harmon, the flow was a sign that the class succeeded in keeping together the topic thread throughout the whole 40 minutes of discussion. Topic maintenance was a benchmark for assessing participation at the class level, and she was satisfied with the overall class participation.

Preparing without explicit directions: Problem-solving skills

In their reflections, teachers often speculated what students were thinking based on their responses. They sometimes marveled how students figured out problem tasks, a second theme described in delightful surprises. Notably, teachers were taken aback when students independently found solutions without explicit directions from the teacher nor much background knowledge about a topic. In the 3 cases where students demonstrated this problem-solving ability, they first discussed the tasks in small groups.

To illustrate, student teams in Mr. Corbett’s classroom were analyzing a scientific procedure. A fictional character in the curriculum planned to test the

hypothesis that ice melted faster with salt. Each team discussed and rated the character's procedural write up. Afterwards, teams argued with one another about the quality of the experimental design, noting why missing steps in the procedure should affect the final score. Listening, Mr. Corbett was a bit surprised by the sophisticated knowledge students displayed about the salt-on-ice experiment:

But for something we haven't done, like the salt and the ice cube, how could they recognize that something was missing? I'm saying, how does this kid know what's missing if they don't know what the full picture is?

Mr. Corbett wondered why students were able to argue about missing items in an experiment they had never conducted before nor had previous lessons about. He also did not provide direct instructions on how to accomplish the task apart from reading aloud with the class the procedure and the four rating criteria. Experience had shown him that students performed better when they were well prepared, and he knew his class did not have much preparation about the topic.

Four out of 6 teachers talked about the importance of pre-debate preparations. They believed students needed to be familiar with a topic before they could engage in a debate or sustain a conversation. Knowledge about a topic meant students were prepared, and the assumption was that prepared students tended to be motivated and more likely to learn from an academic discussion. Mr. Burns, who never reported experiencing a moment of surprise in the recordings, shared this perspective. When asked why mid-way into the video students in a debate were suddenly more vocal and needed less teacher guidance, he reasoned:

At this point they are so prepared and able to create an argument based on the fact that we've already discussed it [in our small group] that I think everybody feels confident. When you are confident, it creates an air of invisibility to where they are not feeling like anybody's judging them on their speaking.

Mr. Burn believed his group could confidently challenge other teams after they were prepared.

Only one teacher stated that she didn't think students necessarily need extensive background knowledge before having a discussion. At her last interview in June, Ms. Harmon decided a debate could occur anywhere in a lesson depending on the curricular objectives. She experienced this in her math class outside of *Word Generation*:

I mean they love the debate so much I almost think you could have one at the beginning, one at the end. In math lately I've been doing activities where they work together...and they are so certain that their answer's correct. But they haven't learned the material yet. They try to prove why they think their answer makes sense versus somebody else's. So I guess you could debate without having any background knowledge. Kind of work your way through the problem that way.

Ms. Harmon thought it was possible to have a productive discussion to develop content knowledge after seeing it work in her own classroom.

However, all teachers conducted their discussions after some type of student preparation, viewing it as a form of scaffold for students learning to express themselves in a public setting. After much reflection about his initial surprise in the salt-on-ice activity, Mr. Corbett concluded that his class knew what was missing because earlier in the lesson they had discussed what made a set of procedures useful. Two students with special needs read out loud step-by-step procedures for making a peanut butter sandwich, while the rest of the class

praised and critiqued their work. His class was also knowledgeable about procedures from their general science classes. Mr. Corbett supposed that students were already provided with good models to think through the problem task. In the end, he did not change his belief that students should be well-prepared before a discussion, but the surprise led him to reconsider what type of preparations were necessary for problem-solving.

Engaging peers academically: Argumentation Skills

Besides familiarity with a subject, teachers also believed level of interest strongly influenced the learning outcomes of a discussion. Teachers therefore quickly noticed signs of student motivation during a discussion, and some did not anticipate the class to become so engaged in deliberating about academically-driven subjects. In 1 out of the 3 cases of surprises about engagement, the teacher Ms. Harmon exclaimed at the onset of her second interview after filming:

I was unsure of how well it was going to come together...I thought I was going to lose. I thought the interest level would be low because they weren't super interested in the overall lesson...But they actually, they did alright. I was pleased.

Ms. Harmon's class had previously conducted a ball and ramp collision experiment, and from the teacher's report, the students were disinterested in the science activity. However, the class was unexpectedly very engaged sharing the results of the experiment with other teams and in whole group, discussing how the findings might apply to real-world skateboarding accidents. In this third type of delightful surprise, teachers noticed the extensive effort that students applied

to constructing their claims.

A key observation in these discussion cases was how students were supporting their claim statements with evidence. In the heat of a debate, teachers watched students intuitively extract information from readings or experiment findings to defend their positioning. For example, in Ms. Owen and Mr. Burns' fishbowl debate, a boy and a girl representing two different teams were refuting each other's arguments on whether or not the Egyptian pharaohs were wise investors or wasteful spenders of their kingdom's economy. Up until this final round, both teachers were strictly monitoring student talk to make sure everyone was on-task. But at this moment, the teachers were silently watching the students take the lead on moving through the debate.

At the interview, Ms. Owen laughingly remarked that their seventh graders were "ready to do battle," pointing at the girl in the video who "was pulling her hair back" in preparation for counter-attacks. Ms. Owen shared how the engagement was unlike what she normally expected to see students do:

I was thinking how amazing it was that they were pulling these facts. Because when you see them in the classroom you're like, I don't know if they're retaining anything. But the two of them are able to pull, and if you turn to page 8, if you look at the Nile River, and if you do this and you do that, so that all of the teaching and learning that had been happening up to that point was coming together. They were able to make those connections and try to outdo each other with their thinking. So, pretty remarkable.

The lively student actions allowed Ms. Owen a chance to evaluate students' abilities to use textual evidence on-the-spot. It was exciting for her to see students so motivated in expressing what they know about history with their peers. In this way, academic discussions provided the veteran teachers the

opportunity to observe, assess, and experience student demonstrations of skills in peer interactions rarely exhibited in other curricular activities.

Disappointed surprises: What students couldn't do

Teachers were just as surprised by what their students couldn't do during an academic discussion. In 5 different cases, three teachers described student behaviors in Word Generation science sessions that momentarily confused them. They had planned activities or guided the conversation based on assumptions that students had prior knowledge about concepts or were familiar with procedural tasks practiced in other lessons. Instead, teachers discovered in 3 cases that students lacked necessary vocabulary to understand scientific concepts while in 2 cases students could not interpret findings as evidence using basic science procedures. The last case entailed a social studies teacher who was annoyed that "compared to the last time where they were all really into it," the most recent discussion did not garner as much student excitement as she anticipated. She could not think of a reason why the dip in enthusiasm occurred. But for the other teachers, the disappointing surprises forced them to reassess student knowledge and consider explanations for why students were unable to perform as they had planned.

Vocabulary

Listening to students talk about science topics, teachers were better able to assess whether or not students understood the scientific phenomenon in the lab activities. A lack of fluency with vocabulary was often a signal to teachers that students were still struggling with concepts. At times, the confusing words were not targeted vocabulary in previous lessons, but words that teachers assume are part of the everyday language middle schoolers would hear. This was what surprised Mr. Corbett who presumed that his media-savvy students were accustomed to the term '3D.'

The students had just constructed a watershed model and were discussing what kinds of models were helpful to engineers. Mid-way into the lesson, they began to argue about the differences between a model and a diagram. One boy explained that a diagram was "2D" while a model was "3D." He folded up and flattened out a paper map in his hands to make his point. Several students interjected with their agreements or disagreements. One girl loudly insisted the creased paper map was still "2D." Watching the video, Mr. Corbett stated:

I think she surprised me that she didn't know what 3D was, and needed to be refreshed on that.

During the lesson, Mr. Corbett stopped the discussion and reminded his class that they had learned some of these very concepts in math. He then conducted a quick demonstration about volumes to help students understand two- and three-dimensional objects. It was an impromptu decision that he never thought of doing until students got into an argument.

It was much more frustrating when the vocabulary students didn't know *were* targeted curricular words. At the first filmed session, Ms. Harmon realized many students were still unclear about vocabulary taught "since the first day of school in August" in their bi-weekly science curriculum. She was disheartened because these vocabulary items pertained to scientific concepts in experimental design, and the whole school had just dedicated an enormous effort in preparing students for a district-wide science fair.

In the unit, the class studied the impact of collisions by rolling a ball down ramps of varying levels of steepness. Student teams measured how far a cup, situated at the bottom of each ramp, travelled after collision with the ball. Most teams claimed their cup moved farthest from the steepest ramp, thus proving steepness affected the impact of a crash. However, one team had the unusual finding that the mid-level ramp caused their cup to move the greatest distance. Students started to brainstorm what other factors may have caused the cup to move a shorter distance from the steepest ramp.

One boy wondered whether perhaps the team had placed the cup farther away from the bottom of the ramp, thus shortening the distance that the cup traveled. Ms. Harmon took this as an opportunity to refresh the idea of holding controlled variables constant, a concept students had been practicing in their science fair projects. But when she asked what principle would be violated if the team really did misplace the cup, the class became silent. She pointed at the science vocabulary wall to give a hint. In a second, a multitude of voices clamored at the teacher as students called out different scientific terms.

At the interview, Ms. Harmon shared her frustration standing in the middle of the din:

At that point I was upset or bothered by the fact that - I feel like they were just throwing words out that they knew were science words. You know what I mean? And just hoping they hit the right one. You know, they were just throwing them out there. That was not where I wanted to be going.

She sensed somehow the moment was not representative of a great discussion with students wildly guessing what she was thinking. But she had expected to hear a unified chorus of 'Constant!' Ms. Harmon knew students were "struggling with these words big time," but she found it unsettling that her students "just couldn't grasp" particular science vocabulary and concepts even after "five tests on it." One boy did finally shout out the correct answer but most of the class failed to pick the right word on the wall.

After reflecting on the event, Ms. Harmon decided that students were challenged because the ball and ramp test was a new topic, and academic discussions were another context for students to think about experimental design:

They've had their own experiments and everyday I'm like "What are your constants?" But you take it out of context, and it's harder for them obviously.

At the time of this first interview, Ms. Harmon did not speak more beyond the realization that students did not know the vocabulary or concepts that she had been teaching all semester. But the disappointing incident caused Ms. Harmon to momentarily think how the context of academic discussions was different from the regular science lessons. In later interviews, she would initiate more

comparisons between what students did in academic discussions and what happens in everyday classes.

Pulling together an argument

Ms. Harmon was not the only teacher who learned during an academic discussion that students did not have a firm grasp on concepts in scientific inquiry. Based on interview reports, sixth graders in our case studies participated actively in school-wide projects that explore, test, and compile results from experiments. Teachers felt students transitioning from elementary school lacked experience in conducting hands-on science investigations and provided them with many opportunities to practice ‘doing science’ in the general curriculum. Thus, they had assumed their class was at least proficient with basic science processes like observing and classifying data and to some degree, predicting and inferring outcomes.

However, academic discussions highlighted the extent to which students were able to apply and integrate inquiry process skills to develop interpretations. Science argumentation entailed the practice of using experimental findings to build a claim. It involved interpreting results to argue for a phenomenon. This level of critical thinking was a new endeavor for middle schoolers. For some, just ‘reading’ numerical measurements and notations was problematic. Teachers were aware of these challenges and planned extensively to scaffold what to infer from results, how to construct an argument, and even how best to present a

position in a public debate. But they did not anticipate that inadequate skills in basic science processes might affect the direction and outcome of an academic discussion.

Mr. Corbett experienced this kind of unexpected setback in his discussion plans when his class began writing claim statements about four white mystery powders. Previously, small teams carefully tested powders for reactions and wrote descriptions of what they saw in their workbooks. On the day of taping, Mr. Corbett had planned for each team to analyze and compare their reported observations to curricular descriptors of chemical reactions. He intended teams to “come up” with a statement using their comparisons as evidence to back up their claims. He then envisioned each team present their arguments in a formal whole class debate, and students would “go back and forth” with each other, agreeing and disagreeing about the observational comparisons.

But to Mr. Corbett’s dismay, during the writing exercise, he noticed that observational notes in student workbooks were peppered with “single words” and “no sentences”:

There was not enough detail in their written notes...They didn’t have enough qualitative data to go back and analyze and say: “Oh, this goes with that” and able to match from the sheets that have been provided to them.

The sparse write-up surprised him. Teams had been very engaged with “working and observing” the mystery powders in the lab activity. He assumed students wrote enough details in their observational notes. Unlike other science exercises, however, pulling together evidence for a debate required students to note more extensive details about their observations and classifications.

Moreover, he discerned teams were “unfortunately looking for an exact match” between their sparse notes and the curricular descriptors, such that their analysis strategies were “impeded”:

They may have written ‘mustard color.’ I think the quote might be yellow. And they say: “Oh, it doesn’t match” - without thinking that geez, mustard is yellow. They’re the same thing.

Mr. Corbett discovered his sixth graders’ inference skills were less developed than he anticipated. Halfway through the lesson, he apologetically informed the research videographer a class debate would not occur as planned. His students were unprepared because they had inadequate notes on which to build a claim.

Swapping notes: Leveraging peer interactions in academic discussion

A sudden shift in teacher perception about what students could or couldn’t do often led teachers to choose another path of instruction. In the case of the mystery powders, Mr. Corbett’s disappointing surprise led him to make a change to his original teaching plan of starting a whole class debate. Instead, he decided to put the small teams of three students into larger groups of six. Since everyone had inadequate notes, perhaps two teams could swap notes and help each other identify the white powders. He split his class into three larger groups and extended more time for the teams to discuss among themselves the data they collected.

In the video, the audio exploded with student chatter. Students were busily sharing what they recalled happened after testing each powder, peering into

each other's laboratory books, or scribbling claim statements. Mr. Corbett visited each larger group briefly and then moved to the edge of the classroom to sit silently on a chair, gazing at the class. In the interview, he stated:

I was looking for who is speaking to whom. I was looking to see who was making eye contact with the others or if they were only half-heartedly listening. And I mean, look at the eye contact from most! You know, a couple guys kind of flit out there but this guy's -- a couple of them are like really engaged. It's a little triangle going on right here which I felt was pretty cool.

At this point, Mr. Corbett was no longer at center stage. He found himself "just watching" his students who were "going off on their own." Experiencing a discussion where students took the lead in piecing together the evidence was "wonderful."

Shortly after, Mr. Corbett asked students what they identified. He attempted a debate although he was still doubtful students could hold one. But when representatives from all the teams proposed their claims, using descriptions of powder reactions from two sets of team observations, Mr. Corbett was noticeably stunned in the video. He shared at the interview:

I thought that they were not going to have as much success as they had. But then they surprised me and they were able to make confirmation on two of the four.

He was "happy" that students were able to logically figure out two powder identities despite each team's incomplete notes. He thought students would react to his inquiries with "We don't get it. What's the answer?"

Mr. Corbett traced the "nice surprise" back to the extended larger group discussion. He stated:

They each needed to hear the other -- they each had a part of the puzzle. And they needed to get the other part from the other person to solve the puzzle.

He had, out of “necessity,” prolonged the group discussion so they could share their experiment observations. But he had not anticipated how collaborative peer interactions could help students solve the problem so quickly. His disappointing surprise had changed into a delightful one after students had time to discuss among themselves the experiment findings.

DISCUSSION

Teacher surprises highlight what teachers see and how they assess student abilities. Since surprises are essentially shifts in what teachers notice, examining surprises can reveal changes in the way teachers assess students. These subtle changes are significant because teacher assessments of what students can and cannot do consequently affect their instructional decisions. In the context of teachers implementing new curriculum, surprises serve as analytical points that illuminate how teacher perceptions have changed after students participate in new types of curricular activities.

Teacher reflections on why student actions were surprising yield insights into how they make sense of student learning in a new curriculum. In this study, veteran teachers reflected on patterns of student talk emerging from academic

discussions. They described what students were doing in their talk and, in the process, explained how students approached an issue or a problem task. They also commented on student dispositions, noting the extent to which their class was engaged in discussing a topic. In their reflections, surprises were often depicted as perceived changes in how students think or behave. Teachers were assessing patterns of thinking and engagement in student talk.

When delightfully surprised, teachers drew links between the implementation and what they saw students doing successfully. At the individual level, they observed that shy students or those with speech-related needs were more motivated in contributing to an academic discussion. Teachers thought this type of class discussion was structured similarly to a small group experience, and the setting encouraged normally reticent students to share their ideas. At the classroom level, teachers like Ms. Harmon were at first concerned about middle schoolers' ability to stay "on topic" with scholarly issues in open-ended classroom talk. But the "flow" that connected academic and personal student experiences moved the discussion towards more science content, not less. Academic discussion attracted student participation and engagement.

Teachers further noticed the effect of supportive peer interactions on overall student understanding. In these cases, students collaboratively worked in small teams discussing a problem task. Teachers were surprised when they came up with solutions without extensive prior knowledge about the subject. Teachers recalled watching groups wrestle with half-formed ideas and reasoned that this small talk helped students make sense of the problem. Although they

strongly believed it was necessary to prepare students for public discourse, by the end of the year, some teachers realized they did not have to teach extensively about a topic for students to perform successfully. As Mr. Corbett reflected, instead of more content knowledge, preparations might be in the form of a good writing model to learn from or repeated practice in a set of science procedures. In discussions where contributions were not limited to correctly answering teacher questions, the focus of peer discourse was on problem-solving.

Apart from collaborations, teachers mentioned disagreements could also enhance student thinking and engagement. In the heat of a debate, teachers watched students become proficient at questioning opposing viewpoints and invested in defending their own propositions. Refuting each other's claims, students spontaneously backed their own propositions with textual evidence from curricular documents. When students in Ms. Owen's class disagreed over whether Egyptian pharaohs were good investors in their country's economy, she was surprised by demonstrations of argumentation skills that were typically not present in her everyday social studies lessons. Even though she and Mr. Burns had prepared students ahead of time on what to debate, Ms. Owen thought engagement with actual peer opponents motivated students into crafting good arguments and created authentic opportunities to test student understanding of sophisticated texts.

When surprises elicited disappointments, teachers were mainly discouraged by what their students couldn't or wouldn't do. They explained how

in other class sessions, students were able to demonstrate particular skill sets or knowledge about a content area. Both Ms. Harmon and Mr. Corbett reasoned that students were having difficulties applying what they knew in the academic discussion because the learning context was different from their traditional course activities. However, this explanation frustrated teachers even more. The failure to apply old skills in new contexts signaled the limited extent students had acquired skills or understanding about a topic from previous lessons. It suggested what Shulman (2000) cautioned, that the classroom talk and modes of instruction used in everyday science classes produced illusionary understanding. Academic discussion called attention to what students didn't know, compelling teachers to reevaluate student abilities from newfound perspectives.

In these reflections about a positive or negative surprise, teachers perceived patterns of student thinking and engagement. Their explanations for these patterns show a beginning awareness of how academic discussion affords effective instruction and promotes student learning. Experientially, teachers gained these three insights from their surprises:

1. Middle school students can engage in academic discussion rigorously and successfully.

Teachers observed their own students challenge peers respectfully, use evidence to support their arguments, and sustain a discussion on an academic topic. Furthermore, teachers like Ms. Harmon saw signs of deepening maturity among middle schoolers, such as the case of the boy who apologized to a girl for

speaking out of turn and then closely paid attention as she repeated her comment. After a year of participating in whole group discussions, students not only extended problem-solving and critical thinking skills, they also were more capable of interacting respectfully with peers.

2. Teachers can conduct a successful discussion even when teaching conditions are not ideal.

Lessons that prepare students for a discussion ahead of time are designed to create ideal conditions for genuine conversations to materialize. Contrary to didactic talk, which is fully controlled by the teacher, students also maneuver the flow of discussion, making this type of classroom discourse more difficult to manage. It is no wonder that many teachers feel the need to prepare students extensively so that students know what to do in the class discussion and are motivated to stay on task. However, when teachers saw students without extensive preparations become interested and critically thoughtful while discussing with peers, they developed an appreciation for middle schoolers' ability to talk and learn from each other. Mr. Corbett, who changed plans to allow more group discussion time before starting a debate, also became more knowledgeable and skilled at knowing when and how peer interactions in academic discussion could leverage student learning.

3. Academic discussion offers teachers another way to assess complex student learning.

In traditional classroom talk, the predominant interaction is between the teacher and a few solicited students. Academic discussion entails different types of discourse interactions, allowing for extended peer talk or student-initiated exchanges. Teachers like Ms. Owen acknowledged this difference when they remarked how students could express what they know differently in a debate setting. Student talk is more varied and in many respects, more complicated. Responses are not restricted to basic answers for pre-determined teacher questions. Instead, talk emerges from an activity like swapping notes to solve a mystery powder challenge or from a disagreement between boys and girls on the role pharaohs should play in decisions about a country's economy. As a result, contributions take on many forms as students describe, explain, and conjecture ideas. Scholarly talk can also be relational in nature when talk builds on a peer's contribution or is supportive of another classmate's perspective. Intrinsically, student talk in academic discussion is diverse and complex.

Consequently, teachers had to acquire more sophisticated assessment strategies. Unlike traditional classroom talk where single responses addressed to the teacher are evaluated, teachers now assess patterns of thinking and engagement through peer exchanges or other modes of interaction. This requires the capacity to understand student talk when students were still learning to express themselves on academic topics and to notice half-formed ideas that can be developed towards deeper content knowledge. This kind of noticing assesses

beyond surface-level facts and, as Ms. Harmon and Mr. Corbett learned, may reveal areas of weak student understanding. It requires teachers to have stronger disciplinary knowledge in order to see where the misconceptions are and the skill of responding effectively in the-spur-of-the-moment, unscriptedly. What teachers look for in discussion interactions differs from didactic exchanges, and this demanding assessment practice builds instructional skills.

In effect, teachers learned from their surprises how effective academic discussion was in advancing student learning. After a year of implementation with their own students, they learned from their experience that discussion ‘works.’ This finding aligns with what Guskey (2002) had found: change in instruction precedes change in teacher beliefs. Particularly when teachers unexpectedly see delightful student accomplishments, they are more persuaded to shift their views. Surprises play a crucial role in influencing teacher beliefs.

Appendix A: Teacher participant and school characteristics

Teacher	Subjects Taught	Grade Taught	School and Location	Student Enrollment	Program Implementation Year
Ms. Walter	Social studies	6	K-8 Urban	526	Second Year
Mr. Corbett	Science and math	6	6-8 Suburban	339	Second Year
Ms. Harmon	Science and math	6	K-8 Urban	888	First Year
Ms. Jenkins	Social Studies	6	K-8 Urban	888	First Year
Ms. Owen	Social Studies	7	K-8 Urban	618	First Year
Mr. Burns	Science	7	K-8 Urban	618	First Year

Appendix B: Number of surprising or unexpected events reported by teachers

Teacher	Number of Recorded Discussions	Number of Surprising or Unexpected Events Extracted
Ms. Walter	3	7
Mr. Corbett	6	10
Ms. Harmon	3	8
Ms. Jenkins	1	2
Ms. Owen	3	3
Mr. Burns	3	0
Total:	19	30

Reports were coded as 'surprise' or 'unexpected.'

Appendix C: Tier two coding scheme - What surprised teachers?

Code	Description	Anchor
Able	The teacher was surprised students knew what to do or was able to perform some task.	"They surprised me that they got the connection on that and then they came up with the second one... So I was thinking they were going to come back to: We don't get it. What's the answer?"
Unable	The teacher was surprised students did not know something or were unable to perform a task.	"I was surprised that like three kids said something like speediness cuz that was the original concept and they were supposed to come up with different ideas. So that was a little – you don't want to shoot them down? But it's kind of like that's what we've been talking about for 45 minutes. We want something that's a different idea."
Inside	The teacher encountered an unexpected event inside the classroom that caused a disruption to the day's planned lesson.	"Oh, so normally there wouldn't have had to be that many transitions. They would've just stayed at their table groups but that student who just walked in and another student had – had a issue I guess right before class and so they weren't in class which then left some tables with people - just one person – which is why I had to have them transition and get into different groups."
Outside	The teacher encountered an unexpected event coming from outside the classroom that caused a disruption to the day's planned lesson.	"I didn't hear the last thing she said. I was kind of distracted by the two students walking in. I was like where they come from?"
Curriculum	The teacher was surprised by something in the curriculum or described how the curriculum caused an unexpected event.	"This was surprising in terms of the level of difficulty."
Preference	The teacher was surprised by what students liked about the discussion in the curriculum.	"They wanted the fishbowl? Actually, I was kind of surprised because the other class picked fish bowl too actually."

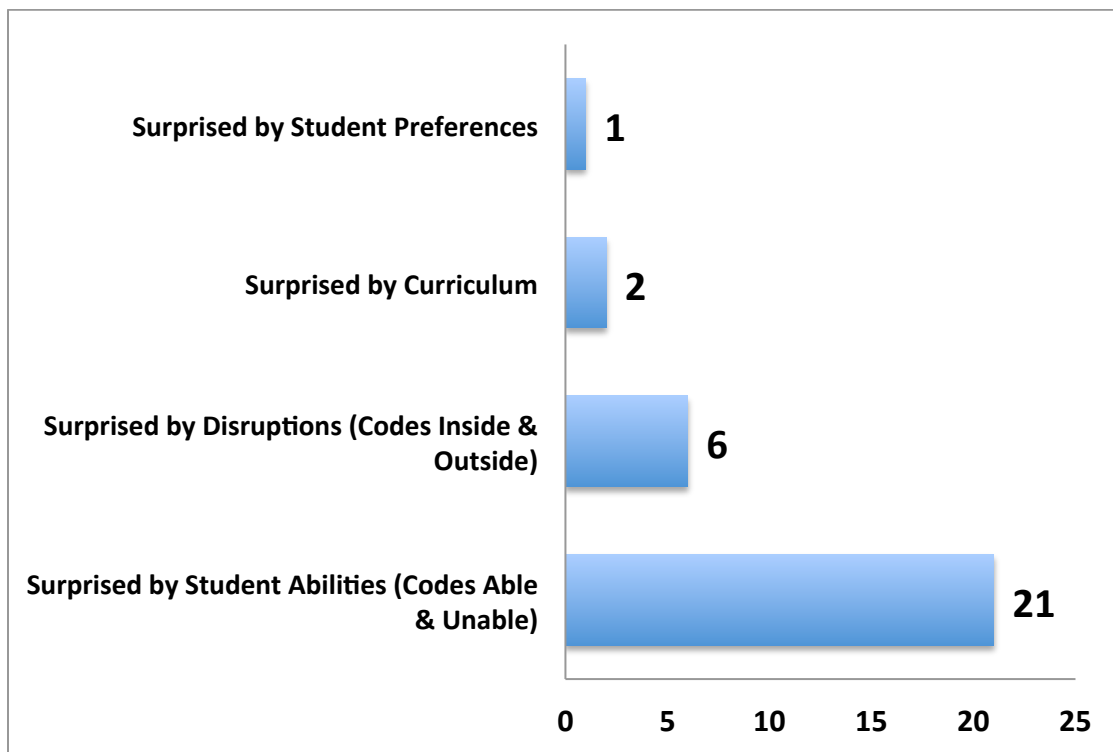
Appendix D: Tier three coding scheme - Why was student performance surprising?

Code	Description	Anchor
Participation +	Even though the teacher was unsure whether students would participate, students were able to participate by contributing a perspective or listening to others during the academic discussion.	"They, the kids have never heard this before. So this was a teaching moment. He brought up a point that I hadn't included."
Participation -	Student participation was lower than expected.	"Just how few of them like just didn't talk at all this time, right? Compared to the last time, right, where they were all like really into it. And then this time I'm just like hoy, you're not saying anything?"
Problem-solving +	After discussing, students were able to conduct problem-solving on a task using evidence when the teacher didn't expect students could do.	"Yeah. They actually - they did fine with it. I'm surprised cuz I was nervous that it wasn't going to go well. Because when I -- because I had asked them oh, did you already talk about the SPLA forces? No. And I'm like, Wow! This is it. Like, this is all they're giving them."
Engagement +	The teacher discovered students were motivated or engaged during the academic discussion.	"So going into the whole group I was like, I really don't know how this is going to work, but it was okay. I thought the interest level would be low because they weren't super interested in the overall lesson."
Vocabulary -	The teacher was surprised students didn't know particular vocabulary words.	"I think she surprised me that she didn't know what 3D was, and needed to be refreshed on that."
Using evidence -	Students could not make sense of the evidence as the teacher had assumed they could.	"They were looking and they saw, they may have written 'mustard color.' I think the quote might be yellow or just the reverse. And they say: 'Oh, it doesn't match' without thinking that geez, mustard is yellow. They're the same thing."

+ indicates a positive, delightful experience.

- indicates a negative, disappointing experience.

Appendix E: What surprised teachers when they led academic discussions?



Total number of surprises: 30

**A case study of a teacher
transitioning into
academic discussion**

The teachers encircled the conference tables, their freshly printed curriculum guides wide open. In the large lecture hall, they listened to the sociolinguist demonstrating examples of teacher questions that ignite student exchange of ideas. Later in the professional development institute, they learn more about facilitating academic discussions in a literacy intervention through workshops led by experienced teacher leaders. One aim of the institute was to give teachers some knowledge and beginning skills needed to hold their own productive and engaging discussions with their students. I followed these new intervention teachers, observing their interactions with facilitators and their reactions to the new curriculum and its pedagogical approaches. A few months after, I shadowed them at their schools and carefully noted the wide spectrum of teacher responses to the actual implementation of a discussion-based curriculum, one intentionally designed to change a teacher's pattern of classroom talk.

In these early field notes about the school sites, there were many teacher descriptions of implementation challenges. Even with the aid of coaches, teachers struggled to teach through and manage free flowing student talk. Their unease echoes what researchers have found, that the majority of classrooms do not promote academic discussion (Nystrand, Wu, Gamoran, Zeiser, & Long, 2003; Mortimer & Scott, 2003). Rather, the professional norm is to focus on content dissemination. If so, the question remains: How do teachers acquire and

put into practice the skills of conducting academic discussion, a type of classroom talk that promotes conceptual learning and participation through student exchanges of ideas?

Back in the messy realities of schooling, far from the exemplars of a professional development institute or the secondary support of a coach, teachers are left on their own to kickstart and move along a student discussion. In this context, they must learn instructional talk skills that incorporate these newer strategies into their existing teaching practices. What is the process they go through to develop such expertise inside their own classrooms?

To explore this process, I conducted a case study of one transitional teacher moving towards academic discussion. The study follows his journey over the course of half a year, mapping his talk patterns at various points in the semester and his moment-to-moment decisions that led to specific talk actions. Findings show that a teaching dilemma initiated the teacher's development of newer talk skills, and he transitioned into a more discussion-oriented teacher through various phases of development. Through an alignment and then integration of these new skills with his prior teaching repertoire, this teacher advanced his instructional effectiveness using academic discussion. The next sections elucidate this process through related themes in the research literature about classroom discourse and teacher change, details of his dilemmas, and the changing descriptions of his talk patterns.

Pushing academic discussions into classroom talk

Classroom discourse, the main mode of instruction between teacher and students, has traditionally been exemplified by students 'reciting' back to teacher questions (Cazden, 2001). This type of exchange script, known as the Initiation-Response-Evaluate (IRE) pattern, begins with a test question prompting students to display their knowledge and ends with teacher feedback evaluating the display (Mehan, 1979). Depending on its function, IRE could affect classroom learning with positive or negative consequences (Wells, 1993). Negatively, an overabundance of IRE scripts in classroom talk keeps learning at the surface level when students are not pushed to elaborate on their responses or demonstrate their reasoning (Nystrand, 2006; Lemke, 1990). In these kinds of instructional interactions, teacher questioning descends to 'fishing' for correct responses from the few students willing to supply answers.

From a Bakhtinian perspective (1981), such monologic instruction prevents students from offering genuine contributions. In contrast, dialogic discussions are centered around learner contributions and teacher follow-up of student-generated lines of inquiry. More student conversational turns and peer-to-peer exchanges proliferate in dialogic classroom talk, allowing for a "refraction" of student voices to compare varied perspectives on a topic. In these types of academic discussions, students learn to critically evaluate claims and develop epistemic understanding of disciplinary knowledge (Osborne, Erduran, & Simon, 2004).

They also work towards better comprehension about issues at stake through deliberation and participation (Michaels, O'Connor, & Resnick, 2008). Quality academic discussions promote higher student achievement (Applebee, Langer, Nystrand, & Gamoran, 2003).

Consequently, educational reforms like the Common Core Standards have pushed for inclusion of academic discussions into classroom practices (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). From a pair-share chat between two students to teacher-led whole class debates, the reforms envision learning opportunities where students engage with one another in collaborative discussions. Through consistent practice in listening to others and offering one's own contributions, students develop academic skills in argumentation, attain clarity of expression, and build on each other's ideas to evolve their own thinking. These student outcomes necessitate a shift in how teachers construct classroom talk - a difficult endeavor since academic discussions remain rare in schools (Nystrand *et. al.*, 2003). Such a discursive shift requires teachers to allow students more participation and control of classroom discourse (Aukerman, Belfatti, & Santori, 2008).

Central to these reforms is the vision of learner-centered instruction created through more responsive forms of teacher talk. In these kinds of 'academic conversations,' teachers go beyond retrieving simplistic, correct answers (Zwiers & Crawford, 2011). They respond to and delve into student reasoning and meaning-making of concepts through effective talk moves. Teacher talk moves are purposeful statements, questions, or other types of

speech acts used to promote student learning by impacting classroom interactions. A set of instructional skills that break the traditional IRE structure, these strategic moves initiate, develop, and sustain complex student exchanges. Responsive to student thinking, effective talk moves shift patterns of classroom discourse towards academic discussions and away from recitation.

Reforming teacher talk: Teachers-in-Transition

Research on educational reforms has consistently documented the difficulties in changing teacher practices (Richardson, 1990; Duffy & Roehler, 1986). Studies about reforming teacher talk are no exceptions (Pimentel & McNeill, 2013; Alonzie, Moje, & Krajcik, 2010). The many reasons cited for these common practices include: time constraints (Newton, Driver, & Osborne, 1999), lack of teacher preparation or sophisticated pedagogical content knowledge to conduct student-driven dialogues (Ball & Bass, 2000), and teacher beliefs, such as perceived limitations in student abilities and motivation (Nathan & Knuth, 2003; Pimentel & McNeill, 2013). Like other types of educational reforms, changing teacher talk and making classroom discourse more learner-oriented is very difficult.

Several researchers have documented dialogic classrooms through case studies that showcase teacher-experts who have successfully incorporated discussion-based practices. For example, Staples (2007) spent over a year with Ms. Nelson, a pre-algebra ninth grade teacher, and analyzed the way Ms. Nelson's elicitation and uptake of student contributions led to deepened

mathematical understanding, even if student ideas were 'half-articulated.'

Swanson, Bianchini, and Lee (2014) depicted the exemplary Ms. H who succeeded in helping her ELL 9th graders craft strong scientific arguments through scaffolding, small group work, and frequent primary language supports. In literacy, Aukerman (2007) demonstrated how a teacher with a dialogic stance could displace himself or herself as the "primary knower" (Berry, 1981). When her case study teacher, Max, refrained from evaluating his fifth graders' non-standard interpretations of a fable, the students critically self-explored each other's interpretations of text. In model cases, teacher-directed control of classroom discussions was curtailed to foster more student participation.

Between studies of classrooms where recitation was prevalent and studies of that small minority of classrooms practicing the idealized discourse, a few researchers have examined average teachers learning to hold academic discussions with their students. An example is Cohen's description of elementary school teacher Mrs. Oublier (1990). Aspiring to adopt innovative mathematics curricula endorsed by her district, Mrs. Oublier implemented these new lessons through very traditional approaches to instruction and teacher talk. Mrs. Oublier represents the iconic *transitional* teacher, one who embraces reforms but has not fully acquired the instructional techniques nor the pedagogical principles underlying the new curricula. Teachers-in-transition, like Mrs. Oublier, exhibit "something old and something new" (1990, p. 312).

Transitional teachers are often represented as oscillating between student-oriented and teacher-centered talk. Christoph and Nystrand (2001) compared

two discussions to demonstrate why teacher orientations vacillate. Kathy, a veteran English teacher, desired to make her high school classroom more "heteroglossic," opening up space for different, even conflicting, student voices to enrich literary perspectives (Bahktin, 1981). In one discussion, she openly solicited student nominations for the most important character in a Shakespearean play. She allowed the students to take control of the debate, culminating in a student-led analysis of text where students reported being thoroughly engaged with the scholarly experience of "fighting with words" (p.275). In this illustration, teacher and students actively pursued similar learning goals, and Kathy was able to both guide and follow her students' lead. At the same time, heteroglossia introduced discursive junctures where teacher and students struggled for control of the conversation. In the second discussion described, student motives for extending a conversation on Pentecostalism contradicted the teacher's instructional intent. Kathy felt she had to coercively veer them toward more curriculum-aligned goals when student-directed talk was not curricular driven.

Hybrid teaching practices

Brodie (2011; 2010) argues for more "textured descriptions" of "hybrid practices" since hybridity may be the professional norm as teachers learn new instructional practices. In the case of Mr. David, a secondary school instructor from Johannesburg, South Africa, hybrid practices emerged from dilemmas caused by competing teaching goals during a discussion. Mr. David was

confronted with the decision to either fully develop a few learners' mathematical ideas that were partially reasoned or extend the dialogue to more students, particularly learners who did not readily volunteer their thoughts. He chose to include more student voices. But Mr. David remained conflicted that he inadequately followed up on student contributions, and thus, relationships among student meanings were not clarified. Brodie viewed his personal dilemma as epitomizing the larger contradictions of implementing reform goals that complement each other in theory but conflict in practice.

Hybridity was originally conceptualized by Cuban (1993) in his historical analysis of teacher-centered progressivism. He traced how from the 1890's, the two teaching traditions, teacher-centered vs. student-centered instruction, found their way into modern classrooms to produce hybrid practices in schools and policies. Follow-up studies (Cuban, 2009) revealed that despite the standards-based reform and test-driven accountability of the mid-1980s, hybridity continued to flourish, although teacher-directed pedagogy still predominately figured into classroom interactions. As teachers "hugged the middle" instead of resorting to the polarized extremes of the two traditions, Cuban ascribed their choices to pedagogical pragmatism - a sense of 'practical decision-making' anchored in the need to be flexible when working with students against the constantly changing educational landscape.

Teacher dilemmas and uncertainty:**Liminal spaces within professional growth**

One common theme in the portrayals of transitional teachers is the predicament of teaching dilemmas. Lampert (1985) conceives of teaching dilemmas as insoluble classroom situations where teachers must choose between competing courses of action. All choices, however, lead to equally undesirable consequences. As a result, teachers can only manage dilemmas instead of simply resolving them.

The ambiguity in dilemmas is often conveyed as a sense of uncertainty. No amount of preparation or training can eliminate the unpredictability that accompanies the role of openly engaging diverse student thinking (Ball, 1993). Teachers are frequently left with figuring out how best to teach using reasonable guesses about overall student progress (Floden & Buchmann, 1993). Teaching has been characterized as inherently uncertain because teachers and students negotiate content, assessment, and classroom authority (McDonald, 1992; Lortie, 1975).

Transitional teachers have been portrayed as conflicted in managing dilemmas and their own uncertainties. In the quandary, they are splintered by contradictory demands and competing instructional goals. Even the notion of hybrid practices alludes to a fractured professional identity. To be pragmatic, teachers resort to a patchwork of traditional and reform instructional strategies, piecing together whatever works in the messiness of real life classrooms. In this depiction, teachers modify their approaches in order to accommodate bits and

pieces of various instructional techniques and ideologies.

Viewing transition as an eclectic collage, however, cannot fully explain how transitional teachers learn and potentially develop. What is missing is a description of integration - how these teachers promote student growth by integrating new instructional practices into existing pedagogical knowledge. From this cognitive perspective (Piaget, 1970), teachers evolve new skills from old ones. As they explore different pedagogical paradigms, teachers are actively reconstructing their knowledge base about student learning. But they rely on their existing knowledge, a system of sense-making built out of past teaching experiences and familiar skills, to construct newer understandings about teaching and learning (Freeman, 2002; Anderson & Smith, 1987). It is prior knowledge that transitional teachers tap into to recognize patterns in classroom interactions and pinpoint the opportune moment to attempt a new strategy (Walsh & Anthony, 2008). Teachers draw on what they know to make sense of dilemmas and identify the best strategies to respond to ambiguous situations. Examining the integration of the old and new can reveal the conceptual pedagogical changes taking place when teachers attempt new forms of instruction. This would broaden our understanding of how transitional teachers acquire and adapt new instructional skills to further student learning.

Developmentally, dilemmas and uncertainties can play a role in integration. Dilemmas act as liminal spaces, the "stuck places" that learners occupy prior to mastery of new concepts (Ellsworth, 1997). Meyer and Land (2005) define liminality as a transitory status where individuals feel stripped away from old

identities, unable to return to their former selves. Yet, having not arrived into their next state, they struggle with the new experiences that require alternative modes of understanding. Although being in liminal space is initially troubling and problematic, liminality signifies that individuals are at the boundary of a "conceptual threshold." They stand at the brink of a significant shift in their internal understanding of a subject matter that reorganizes their world view and their self-identities. Applied to the experiences of transitional teachers, dilemmas can represent the liminal point at which teachers formulate alternative understandings about their student interactions as they struggle to integrate existing and newer pedagogical paradigms. Dilemmas thus mark the possible entryways into newer conceptual thresholds, and the integrated actions of teaching are the observable signs of this crossing.

Teacher talk as skillful actions

Exploring integrated talk moves as "knowledge-in-action" (Schön, 1983), I analyze teacher talk in a case study of one transitional teacher to better understand how he acquired the skills and the knowledge required for using academic discussions to promote student learning. I frame teacher talk using Schön's conceptualization of skillful actions. Talk actions that address novel problems or situational dilemmas in the workplace are forms of specialized knowledge embedded with strategies, theories, and judgments. A teacher's tacit knowledge (Polanyi, 1967) can be revealed through reflection about particular actions.

In the case study, I focus specifically on two talk moves, *waiting* and *pressing*, that were new to the teacher. I track how he applied and through reflection, made sense of these two moves over the school semester. These moves were spontaneously applied whenever he encountered a teaching dilemma, one where he experienced competing instructional goals during the discussion. In managing the dilemma, he used his existing pedagogical understanding as a resource to support his efforts at applying new moves. I argue that when he integrated his new talk strategies with his existing knowledge, his understanding about and performance of conducting academic discussions shifted.

Jeff the Transitional Teacher: Study setting and participant background

This case study was conducted in the context of a larger research program, *Catalyzing Comprehension through Discussion and Debate (CCDD)*, a longitudinal, experimental study funded by the Institute of Educational Sciences to investigate the development of sophisticated reading comprehension in middle school students. Intervention schools from four districts adopted *Word Generation*, a school-wide literacy program featuring weekly structured discussion and debates for 4th through 8th grades. *Word Generation* teachers across the content areas were encouraged to conduct academic discussions regularly, on topics supported by the curriculum. Teachers were invited to attend a Summer Institute that introduced literacy research and how academic discussions supported student learning. During the school year, they also had access to an on-site coach who supported teachers' efforts with implementation. From the larger CCDD study, a subset of volunteer teachers were recruited to participate in a more intensive study involving classroom observations, videotaping, and interviews.

Jeff was a veteran math and science teacher from this sample who agreed to participate in my study. When I interviewed and observed Jeff, he was in his second year of implementing the program. He worked in a small district within a popular tourist region in the Northeast. His district served 3500 students, including students of transient, seasonal workers.

About 38 percent of the students were eligible for free or reduced lunch, and teachers had reported that some students were homeless, living with their families in motels. In recent years, the district had struggled with declining student enrollment due to school choice programs and private or charter schools, forcing potential redistricting. At the same time, the English Language Learners (ELL) population had risen.

Jeff had taught in this district for the past 36 years and was a highly respected 6th grade teacher in the school community. He strongly identified as a science teacher, and his classroom reflects this professional identity. At one corner of the room, there was a lab demonstration table with vials and tubes stacked neatly next to each other. Two white boards hung on either side of the walls next to bulletin boards full of student diagram sketches. Tagged above the panels were science vocabulary words. In the center was a smart board that he often used to augment discussions with additional science and math content. At the other end of the room, an aquarium tank bubbled quietly under the constant buzz of student activities in Jeff's classroom. Jeff used a variety of science materials to scaffold student learning, and his lessons were always brimming with activities packed into one short period.

Comparatively, Jeff was striking in the sample of filmed teachers. Aside from having the most teaching experience in the group, he was especially articulate in sharing his pedagogical reasons and was comfortable with verbally probing his own thinking. He was open to trying out new curriculum and believed that *Word Generation* could develop better science communication skills in

students at his school. In fact, *Word Generation* coaches have reported that Jeff's whole grade level team was particularly invested and collaborative with adopting the intervention. In year one, they met weekly to discuss implementation successes and challenges with a coach and modified aspects of the curriculum to better accommodate their particular student needs. Despite this, a preliminary analysis of early *Word Generation* discussions in Jeff's classroom indicated that overall, classroom talk gravitated towards conventional forms of IRE exchange. Data analysis of discussions in the second year, however, exhibited increased episodes of dialogical bids followed by elaborated student responses and turn-taking. Jeff's extensive teaching experience and dedication to implementing academic discussions made him an ideal transitional teacher for a case study.

Action to Reflection: A Two-Step Data Collection Procedure

To generate descriptions of how Jeff was learning to initiate and sustain academic discussions, I analyzed videos of Jeff's classroom discussions and examined his reflections about talk actions on video. My data collection incorporated a two-step process.

In step one, we videotaped specific lessons where Jeff anticipated holding a discussion or debate with his students. Although Jeff made frequent use of small group or paired chats, we aimed to document teacher-led, whole group discussions. A research assistant filmed the class following the teacher with one video camera while digital recorders placed at each team table taped student

talk. I took copious field notes and sketches during the lesson, noting teacher and student actions approximately every 3 to 5 minutes of observation. Jeff was filmed six times implementing five different Word Generation science units from December to May.

In step two, I interviewed Jeff for his "reflections-on-actions" using his videotaped sessions as a guide. Schön (1983) advocates for reflection as a process for concretizing tacit knowledge underlying professional actions. In his case studies, professionals reflect out loud, exploring how they frame a problem and solve it with decisive actions. Similarly, Shulman (1998) describes how reflective practice can help teachers identify the dilemmatic contradictions in their professional work and objectify the specific actions they take to manage uncertainties. After every taped discussion, I conducted a think-aloud reflection, analogous to the stimulated recall procedures common in researching teacher decision-making in naturalistic contexts (Lyle, 2003).

In Jeff's case, his recall was stimulated through the videos of his own practice (Sherin & van Es, 2005). Jeff and I reviewed the full video together on a laptop. We honed in on specific 'events' or sequences of teacher and student turn-taking interactions, at the beginning, middle, and end points of a discussion. I used time codes from my field notes to segment events for replaying. In these events, I specifically looked for teacher moves that promoted or hindered extended student responses. However, the interview was semi-structured, and Jeff also took the lead in selecting events that he thought were useful to probe for his own decision-making processes. In five of the six recordings, Jeff was

interviewed approximately two hours after videotaping. The final recording in May was used as an exit-interview where I showed him clips of discussions from throughout the year to stimulate meta-reflective narratives about his class and his own development in using academic discussions.

To guide the recall, I borrowed a technique of reflective practice from clinical education called advocacy inquiry (Rudolph, Simon, Dufresne, & Raemer, 2006). First, Jeff was asked to explain what was happening during the event and describe teacher and student actions. In explaining, he often shared his instructional intentions and identified teaching dilemmas. Next, Jeff recalled what situational factors and thought processes led him to enact particular teacher actions, or talk moves. This technique elicited how he framed the situation and made decisions. Finally, Jeff shared his experiences of enacting specific actions, including moments when he felt uncertain or surprised about unfolding events.

Waiting and pressing: Emergent data analysis of two skillful actions

In data analysis, I explored how Jeff described his own talk moves and the reasons he gave for applying them in specific situations. I also studied whether and how his talk patterns changed at various points in the semester. Both analyses highlighted Jeff's skill and knowledge acquisition in sustaining academic discussions. To begin, I developed two sets of analytical categories through inductive and deductive inquiry.

The first set of data-driven codes (Boyatzis, 1998) was generated thematically through interviews from the larger teacher sample in the videotaping

study. A selection of codes described teacher intentions for their talk moves and their reported experiences in applying particular moves. Examples of such codes include *intention to monitor participation*, *intention to deepen content learning*, and *sense of control* (See Appendix A). After coding Jeff's interviews using these selected codes, I constructed the unit of analysis: *dilemmatic event*. A dilemmatic event is a juncture in the video where Jeff described having at least two instructional intentions and feeling uncertain about the potential outcomes of either. His descriptions suggested that these intentions conflicted with each other.

Through pattern matching (Yin, 2009), I compared dilemmatic events within and across Jeff's six interview transcripts, looking for similarities and differences. One type of dilemmatic event repeatedly emerged. Whenever students with special needs volunteered to speak in Jeff's inclusive classroom discussion, he struggled with managing participation and content learning. Honing in on this group of dilemmatic events, I further analyzed Jeff's descriptions of classroom interactions, his framing of the dilemma, and the situational factors that influenced his decision-making.

After identifying this select category of dilemmatic events in the interview, I investigated the corresponding discussion sequence in the video. All Jeff's videotaped discussions and a portion of the audio-recorded student group talk were transcribed. I coded the related discussion sequences using a second set of theory-driven codes derived from the literature on classroom discourse (See Appendix B). Drawing on conversational analysis, these codes differentiated

teacher and student turn-taking exchanges. Next, I juxtaposed Jeff's own descriptions of his talk moves to those specified by research, pattern matching across the six videos. Finally, I conducted a broad analytical review of each discussion, specifically examining shifts in topic maintenance (Crow, 1983) to check for overall adherence to curricular topics and incidences of argumentative flow that connected teacher and student turn-taking exchanges. This analytical scan attended to sequencing of the discursive event to better understand how specific talk moves in the event promoted or hindered the development of the whole discussion.

From these analyses, two talk moves materialized as key skills in Jeff's development. Over several dilemmatic events, Jeff talked about the actions of *waiting* and *pressing*. In the research literature, both wait time and press moves are considered as reform-oriented talk strategies. Wait time is the length of a teacher's pause after an initial question or following a student response, and early studies have shown that on average, teachers pause for only one second before moving onto a new question or student (Rowe, 1986; 1974). However, an average wait time greater than the threshold value of 3 seconds is associated with expanded student-to-student interactions and higher cognitive level achievement in K-12 contexts, presumably because longer pauses allow students and teachers more time to think during classroom interactions (Tobin, 1987).

Alternately, press moves are teacher questions that 'press' for conceptual thinking, pushing students to go beyond a simple, correct answer (Kazemi &

Stipek, 2001). Pressing seeks to advance student skills in explaining and justifying their reasoning (Brodie, 2011). When press moves are used after extended wait time, the concurrent strategies are known to engender coherent, relevant student responses and co-construct learning between teachers and students (Maroni 2011; Rowe, 1974).

This case study traces the process by which Jeff learned to integrate the skills of waiting and pressing into his existing repertoire of teaching strategies. I select three focal dilemmatic events representing critical cases in Jeff's development (Yin, 2009). Outcomes in each event were perceived by Jeff as rewarding and successful enough to slightly shift his thinking about instruction in academic discussion. Sequentially, the three events can be described as phases of *alignment*, *early integration*, and *transition*. These phases and their particular characteristics are summarized in Exhibit 2 on the next page. In the findings section, I present a close analysis of each phase, beginning with an overview of Jeff's teaching dilemma and his talk strategies at *baseline*.

Exhibit 2: Phases of Jeff's Talk Skills Acquisition

Baseline	Alignment	Early Integration	Transitional
<p>Teacher Talk: Teacher-directed, topic-controlled in the discussion</p> <p>Teacher Reflection: Teacher intended to reach curricular objectives and have students participate in academic discussion to learn "the language of science."</p> <p>Feature of baseline phase: A desire to try discussion instruction</p>	<p>Teacher Talk: Explored two new talk moves - wait and rephrased questioning</p> <p>Teacher Reflection: Teacher thought new moves would help him teach curricular content and increase participation of a student with special needs. He was unaware that moves were misapplied and misconceptualized.</p> <p>Features of alignment phase: a) Exploration initiated by a teaching dilemma b) Although misused, the moves aligned to teacher's existing scaffolding expertise. c) Teacher experienced a successful outcome.</p>	<p>Teacher Talk: Applied extended wait time and press moves effectively</p> <p>Teacher Reflection: Teacher was aware that press and wait moves applied pressure not only on one student but the rest of the class as well. He knew the right amount of pressure for success required balancing pressure on both dimensions.</p> <p>Features of alignment phase: a) Classroom climate was supportive and allowed teacher to risk applying alternative moves b) Teacher enacted not only two new moves correctly, he performed more sophisticated forms of scaffolding. c) Teacher experienced a successful outcome.</p>	<p>Teacher Talk: More student-centered, more able to facilitate exchanges between students</p> <p>Teacher Reflection: Teacher believed he was becoming a facilitator in classroom discussion.</p> <p>Feature of alignment phase: Teacher feels he can balance his dilemma of teaching content and increasing participation better.</p>

BASELINE PHASE

To reach curricular objectives:

Using monologic, topic-controlled teacher talk

Early in the study, Jeff shared two pedagogical intentions for conducting academic discussions. First, he was keen on using classroom conversations to reach lesson objectives and cover science content. Secondly, he wanted to encourage student participation in discussions. Jeff believed in the significance of STEM education, the blending of skills and knowledge in the disciplines of science, technology, engineering, and math. In the interviews, Jeff demonstrated an awareness that academic science talk - “science communication” - could help his students gain more STEM knowledge. He thought providing students to more “exposure” to science talk would familiarize them to “STEM” vocabulary words as well as the target words introduced in *Word Generation*. Thus, he intended for his students to “expand their language, their use of the science language.” Science language could help deepen student understanding of scientific concepts and STEM knowledge.

I studied how Jeff initially achieved his first intention of reaching lesson objectives and covering content using three discussion transcripts from earlier recordings. Two transcripts came from our December and January recordings. A third transcript was a discussion about rap music, and this discussion was filmed in the previous spring semester during Jeff’s first year of implementation. In these

recordings and transcripts, Jeff focused the classroom talk on specific concepts and skills relevant to the unit objective. He began by posing test questions at the start of a discussion and then ‘fielded’ several answers from different students to exemplify the topic. He followed up on selected student comments that expanded the main curricular points and redirected off-tangent remarks. Jeff did allow a few tangential student contributions, ones that related students’ everyday personal experiences to abstract concepts in science and civics. However, Jeff overall sought to maintain topic control through detailed elaborations and explanations of content. Consequently, in the earlier recordings, the transcripts were comprised largely of teacher talk and only a few student responses.

The following transcript excerpted from the January recording illustrates this pattern of topic-controlled talk. In the unit, “*Why do we make models?*” students built a tin foil watershed to examine how rain water carried pollution across hilly and flat terrains. Right before the lab activity, Jeff held a whole class discussion to scaffold student observations. His instructional intent was to help students understand how models afforded representations of real phenomena, one of the curricular goals of this unit:

Event 1.1: Class discussion on model affordances

- 01 **Teacher:** Thank you Ladies and Gentlemen...Can you just briefly kind of review
 02 for me – kind of refresh what models are made for in the first place? Why
 03 would a person bother to create a model? Tim.
- 04 **Tim:** To like, see what it will look like? Or to see what will happen at the end?
 05 To not like, to not mess up on the real thing. It’s kind of like a copy, if that
 06 makes any sense.
- 07 **Teacher:** Okay, thank you. (*Points to another student who raised his hand*)

- 08 **Daniel:** To test.
 09 **Teacher:** (Nods) A model to make a test.
 10 **Daniel:** Yeah, like you model of a test of – like, it's kind of like related to
 11 simulations and models. It's kind of like –
 12 **Teacher:** Oh so simulations – what does the word *simulation* mean to you when
 13 you study a model?

(Hands are raised in the background as more students volunteer.)

- 14 **Daniel:** To test something. To make it feel like a drill but it's not.
 15 **Teacher:** (Nods) Okay, we're trying to test something to make it seem like a drill –
 16 **Daniel:** So it's kind of between a simu - So it's a model, a simulation, and kind of
 17 a diagram.
 18 **Teacher:** Thank you. I think ah – we're going to *simulate* today what the watershed
 19 would be like. We can't really go outdoors – Why are we bothering to
 20 make a model of the watershed? (*Pointing to a raised hand*) Sarah?
 21 **Sarah:** So we don't harm anything.
 22 **Teacher:** Oh okay. So I told you that we're going to put some imaginary poison
 23 down. But we can't put any actual poison down in the real watershed
 24 outdoors. Because we don't want to harm anything – those are Sarah's
 25 important words there.
-

In these exchanges, Jeff highlighted aspects of student responses that he thought illuminated what models do. For example, he interrupted Daniel's contribution to target the idea of simulations (line 12) since students would later simulate a watershed. Before asking why a model of a watershed would be helpful in studying the natural world, he hinted at why they couldn't really perform such an experiment outdoors (line 19). Sarah's correct answer that models are safer to experiment with (line 21) further embellished the lesson topic on model affordances, and her response was subsequently followed up by Jeff to highlight its importance (lines 23-25). Starting from a general inquiry on what models are made for to a more focused question about safety in modeling, Jeff's questions become increasingly narrowed. Fielded responses were only directed to the

teacher with no interactions occurring between students. Through these tightly controlled exchanges and streamlined inquiries, Jeff pursued curricular agendas in classroom talk. He did, however, highlight important student contributions that advanced the topic. At this baseline phase, Jeff used elaborated Initiation-Response-Evaluate (IRE) patterns of classroom talk to accomplish his first intention of teaching science learning objectives.

Teacher talk 'interrupted': A conflict between content and participation

However, Jeff had a second intention as well, one related to student participation and engagement in an inclusive classroom. Of the 18 students present during filming at various points in the year, there were between four and six students on an Individualized Educational Plan (IEP) for behavioral or academic reasons. Jeff was particularly concerned with exposing his students with special needs to academic science talk. He had to consider how “best to service” the variety of special needs he encountered, including the “few on the autistic spectrum,” as he aimed to increase their verbal participation in class discussions with other general education students.

Working within this diverse range of student strengths and challenges, Jeff faced a teaching dilemma generated by his two pedagogical intentions. His commitment to provide participatory access for special needs students contested with the desire to push ahead curricular objectives in a discussion. Jeff could not as easily ‘field’ correct answers from his special needs students to highlight a topic. Some of them required more processing time to follow a line of

questioning or additional clarifications to make sense of evaluative feedback. He could not simply correct student errors or move on to another general education student to get to the point of a lesson. In public discourse settings like classroom discussions, Jeff was aware that peers also judge responses. How he chose to repair errors in front of general education students could bolster or break down the confidence of his special needs students. Hence, in an inclusive environment, Jeff's usual monologic talk was 'interrupted.' He had to explore new ways of interacting with his students.

ALIGNMENT PHASE

To stay with Sammy: Aligning a wait move to increase student participation

What happened in the video: A dilemma about Sammy

In the same January discussion about scientific models, Jeff's teaching dilemma surfaced. Mid-way into the discussion, he initiated a topic change and began to ask questions about the drawbacks of using models to represent the natural world. In the video, Jeff pointed to the word 'limitations' written in bold on his whiteboard and asked how the students' tin foil watersheds behaved differently from real watersheds. Several students, including Sammy, raised their hands to volunteer an answer. Jeff pointed to Sammy, a short and slender boy identified as a student with special needs during an interview prior to the January recording:

Event 1.2: Class discussion on model limitations

- 36 **Teacher:** Now we'll come back to the phrase here. There's some limitations to the
 37 parts of the model that you're using. Limitations mean – mmmm- not
 38 exactly as good as the real thing. So what are some limitations with the
 39 pieces of equipment that we are using today? We're using paper, tin foil,
 40 and we're using marker. How is that very *unlike* the real thing? (*Tilts*
 41 *head towards Sammy*) Yes?
 42 **Sammy:** Well. For one -
 43 **Teacher:** Speak a little loud so that I can hear. I need to just be able to hear you.
- 44 **Sammy:** For one, if the reason you can't build it is because some of this stuff we
 45 made is already there. And because like a lot of other people are saying,
 46 we cant really put poison on the ground because you could get fined or
 47 something.
-

Softly spoken, Sammy drew out his vowel sounds in a monotonous tone, making it difficult to understand what he articulated. His statement was incoherent and did not make sense in response to the teacher's inquiry. Sammy's remark about "poison" (line 46) was a reference to the earlier conversational topic about the affordances of modeling. Previously in line 22-23, the teacher had explained that with models, one could use "imaginary poison" instead of placing "actual poison down in the real watershed" just to examine what would happen to polluted waterways. Sammy's mistimed reference suggested that he was a pace behind in processing the topic switch from affordances to limitations.

In the video, Jeff knitted his brow and then proceeded to use a series of questions to retrieve a correct answer from Sammy. He repeated his question again (line 48) and then further elaborated that he wanted to know how the materials used in class to build the watershed differed from those in real watersheds. Sammy made a second attempt at a response (lines 53-54) , and

Jeff asked for a clarification (line 55):

Event 1.3: Dilemmatic event with Sammy's delay

- 48 **Teacher:** 'Kay. So. But you're not telling me why the materials might not work as
 49 well?
 50 **Sammy:** Because –
 51 **Teacher:** That's what I'm trying to get at. Can you tell me how the materials that
 52 we have in class might not work as well as real objects in life? *That's*
 what I wanted to get at.

Three other students immediately raised their hands high up in the air.

- 53 **Sammy:** Because the models aren't exactly like it. So there could be something
 54 different that happens than what would happen.
 55 **Teacher:** In what ways are they different?
 56 **Sammy:** Like, we have tin foil and you can either make it smooth or bumpy. And
 we could be in a bumpier area, and it could be a smooth model.
-

In his last turn (line 56), Sammy explained how a smooth model could misrepresent the actual hilly terrain the class was trying to replicate. When he stated his contribution more clearly, the teacher acknowledged and followed up on Sammy's answer. Jeff's voice was noticeably enthusiastic and excited:

Event 1.4: Uptake of Sammy's response

- 57 **Teacher:** Okay, here we go! I understand what he's saying. He's saying that if we
 58 decide to make a bumpy model compared to a fairly flat model it might
 59 be different.

Teacher sketches out a bumpy hill and a flat horizontal line on the whiteboard.

- 60 **Teacher:** For example on Cape Cod –we're trying to talk about the watershed on
 61 Cape Cod, and we have used a very flat bedrock then it might behave in
 62 a way like real life. But if we made Cape Cod look like a mountainous
 63 region, then the model might not behave as it would in real life.
 64 **Sammy:** (*Nodding*) Yeah.
 65 **Teacher:** Bingo! I followed what you meant!
-

Analysis of Jeff's exchanges with Sammy: Teacher questioning as scaffolds

To bring Sammy into the conversation and move the topic forward for the whole class, Jeff relied on *teacher repairs*, or teacher error corrections (Lyster, 2001). He used narrow, concrete questions to steer Sammy into a correct response. This strategy required Jeff to strictly control the topic. However, in the three exchanges that followed, Jeff's grip on topic control was temporarily loosened when his questioning shifted to elucidating Sammy's thoughts.

Jeff originally asked *test questions* about how foil and paper materials differed from real bedrock matter (lines 38-40). He tried rephrasing this request and added, "That's what I wanted to get at" (line 51) to redirect Sammy's attention to the topic switch. This closed line of questioning was directed towards helping Sammy form an appropriate comment on how materials in the models acted as constraints. However, Sammy's reply was ambiguous in this second exchange. He stated that the materials might produce effects that are "different" than "what would happen" with actual watersheds (lines 53-54).

At this next juncture, Jeff asked the *clarifying question*: "In what ways are they different?" (line 55). It prompted Sammy to be more explicit about his comparisons. In the process, Jeff momentarily forwent his own line of questioning about materials. His clarifying question trailed after Sammy's line of thinking, and his stance on controlling the topic softened when he chose to better understand what Sammy was referring to. The question succeeded in eliciting Sammy's more articulated comparison between smooth models and hilly terrains (line 56). The clarifying question became a key move in the series of repairs that

scaffolded Sammy's response.

Much like the temporary wooden scaffolds that support the construction of buildings, scaffolding is an educational metaphor for various strategies that support learners in completing tasks they otherwise would not be able to accomplish on their own (Woods, Bruner, & Ross, 1976). In scaffolding, the teacher can skillfully interpret learner responses and determine what feedback is most appropriate at specific points in the task mastery. Commonly associated with Vygotsky's (1980) zone of proximal development, effective scaffolding entails educating students based on their potential developmental levels. A teacher gauges the distance between a student's current level of understanding and his potential capacities. Then the teacher appropriates "well-tuned" scaffolds to deepen understanding based on a student's potential capabilities (Cazden, 2001). Referred to as *contingent teaching* (Tharp & Gallimore, 1988; Pol, Volman, & Beishuizen, 2011), responsive scaffolding is the act of making instructional decisions based on what students already know and how far they can achieve.

Intending to bring Sammy into the dialogue, Jeff initially used test questions as scaffolds, hinting at the correct answer and redirecting him to the topic switch at hand. But in asking a clarifying question, Jeff engaged in contingent teaching. He became responsive to what Sammy was struggling to express, striving to understand what Sammy meant by "different." Jeff's questioning stance subtly moved to a more open form. In a discussion that functioned mostly as teacher-directed instruction, the interaction with Sammy opened up the dialogue to a less

constrained pattern of talk.

Furthermore, Jeff followed up Sammy's comparison by augmenting his ideas with sketches of horizontal and bumpy lines (Event 1.4). He reformulated this contribution with references to the local environment that further explicate comparisons. Jeff essentially *revoiced* Sammy's contribution (O'Connor & Michaels, 1993) to achieve two interactional functions. The reformulation illustrated how models differed from real phenomenon in limiting ways, emphasizing one of the lesson objectives for the discussion. The reformation also acted as a teacher *uptake* validating Sammy's participation. It legitimized the student's contribution, valuing it as an important idea worth exploring, one that 'fits' into the whole group conversation. Jeff had been using revoicing even in his IRE interactions and was now applying the technique adaptively in academic discussion. Through revoicing and scaffolding, Jeff managed his dual intentions of meeting curricular goals and extending Sammy's voice.

How the teacher perceived the event: Staying with Sammy

"I'm glad that I stayed with him."

That was Jeff's immediate remark during the interview when the video zoomed into Sammy faltering at his first answer. Jeff stated he made a decision to "stay" with Sammy instead of moving onto another student for a correct response. He thought perhaps Sammy had the right answer but was just

struggling to articulate it:

It's like maybe he [Sammy] does know the answer. If he doesn't get out the first time, it doesn't mean he doesn't know it...So they try to teach us nowadays - *wait time* - to stick with the kid, and maybe rephrase the question. Rephrase what you're looking for.

Jeff perceived his instructional response as an act of *waiting* until the student could achieve some level of success. By staying, he considered his own talk moves as extending the dialogue with Sammy in order to give him more time and a second chance to produce a coherent contribution.

Appendix C is a juxtaposition chart displaying what was watched in the video clip and what Jeff stated immediately after watching the clip in the interview. The chart shows Jeff's reflections about his interactions with Sammy on the video. Along with describing his actions as waiting, Jeff explained the reason why he chose to stay particularly with Sammy. He felt Sammy needed more self-confidence that he could be successful in a discussion setting:

This little student needs a little boost. He needs to, he needs to get a hit, so to speak.

Later in the interview, Jeff added that both general education and special needs students were inexperienced with expressing themselves in public discourse. He suspected that in elementary school, his sixth graders did not get much practice in discussing science topics. When they come into middle school in the fall, he noticed students lacking in presentation and deliberation skills. But with practice, Jeff believed they could improve. He perceived Sammy's delay as a potential contribution, not an error, a perspective associated with contingent

teaching. Jeff assessed Sammy and the instructional context through a scaffolding framework.

Interpreting wait time and rephrasing:

Moves aligned to Jeff's expertise in scaffolding

Jeff indicated that he learned in professional development to wait and to “rephrase what you’re looking for.” His initial understanding of these two alternative talk moves was shaped by his prior knowledge in scaffolding. He regarded waiting and rephrasing as strategies that would “stick with Sammy” until enough supports scaffolded an appropriate answer. He thought what Sammy needed most was extra time and more detailed directives to process a topic. The suggestion to combine the two moves of waiting and rephrasing corresponded with Jeff’s assessment of Sammy’s learning needs. In the January interview, Jeff believed he applied extended wait time and effective questioning as intended by educational reforms.

However, Jeff did not enact waiting and rephrasing as construed by research. Using a video time counter, I measured Jeff’s pauses after Sammy’s responses in the interaction (lines 41-56). The pauses displayed lengths of one second or less. Jeff’s pauses did not extend beyond three seconds, the duration associated with extended wait time (Tobin, 1987). Nor did Sammy form a coherent response after a rephrased question. It was a clarifying question contingent to Sammy’s thinking that yielded a better response. Much like Mrs.

Oublier, the transitional teacher who misconceived instructional reforms and implemented new curriculum using traditional strategies (Cohen, 1990), Jeff misused the move strategies as defined by research and reform policies.

But in Jeff's case, his first attempt at applying these new moves emerged from scaffolding a student in a discussion. He recognized a learning situation where his previous style of teacher talk could not achieve his second intention of increasing Sammy's participation. Thus, he began exploring alternative talk strategies. This initial exploration was aligned to his expert understanding of how scaffolding works with students with special needs. Although misapplied, Jeff's decision to apply the moves of *waiting* and *rephrasing* questions represented a significant step in his development as a transitional teacher. He was aligning new ideas about teaching and learning to his existing pedagogical knowledge.

This alignment is even more significant because the exploration led to a successful outcome for Sammy, but not in the way Jeff originally intended. He described Sammy's final coherent contribution about bumpy terrains as a "teaching moment" (see juxtaposition chart in Appendix D):

They, the [general ed] kids, have never heard this before. So this was a teaching moment. He brought up a point that I hadn't included - that we're trying to *replicate* [name of local environment] where there are some hills called a moraine.

Illustrating how models are not exact copies of the local environment was not the answer that Jeff was scaffolding for. But he excitedly stated that the response "fit" into the broader topic about limitations, and Sammy "took us into a whole different direction. That's pretty cool." Not only was Sammy coherent, he produced a contribution that oriented him and the class to other ways of thinking

and talking about model constraints. For a brief minute, Jeff slightly shifted towards student-centered classroom talk, and the success of Sammy's participation was emotionally rewarding.

The Alignment Phase:

Exploring alternative moves that align with existing expertise

The alignment phase in Jeff's experience of becoming a more discussion-oriented teacher is characterized by three significant features. His initial entry into this transitional phase was prompted by a teaching dilemma. Jeff's usual topic-controlled, monologic talk strategies allowed him to cover content and reach lesson objectives. But this pattern of teacher talk excluded students like Sammy from becoming successful participants in a class discussion. It was his attempt at resolving the teaching dilemma that motivated him to explore alternative talk strategies.

The second feature involved tapping into Jeff's existing instructional expertise. Sammy had difficulties processing quickly any topical shifts in a group discussion and articulating clearly his ideas. Jeff's assessment was that Sammy only needed directives to signal a topic change had occurred and more time to express his thoughts. He tried to scaffold Sammy into a correct answer by applying what he thought were reform-oriented talk moves, waiting and rephrasing his original question to Sammy. Jeff interpreted these newer

strategies based on his prior knowledge of successful scaffolds. Although well-intentioned, the moves were misapplied and misconceptualized. However, the alignment of moves to Jeff's expertise in scaffolding instruction was crucial because it encouraged him to experiment with new talk moves.

The final key feature is Jeff's positive experience of success. Although he only partially implemented the new talk moves, he was able to attain both curricular objectives and his intention for Sammy to participate successfully. This positive outcome inspired him to continue exploring discussion instruction despite his feeling of uncertainty about the teaching dilemma.

Experiencing waiting: A role for uncertainty

Although Jeff considered his moves successful, in retrospect, the decision to wait stirred within him a sense of uneasiness. Jeff was cautious about enacting the wait move. He shared that a few of his special needs students were diagnosed with "anxiety issues." Pointing to another girl sitting beside Sammy, he explained how a miscalculated wait could backfire:

You have to kind of weigh how much wait time you're gonna give. Am I putting more stress on her that's gonna make her more anxious? Or, is the correct answer gonna make her feel so good about herself? It should feel good... you know, strong that she's received by the kids. So it's a judgment call.

Scaffolding an answer in public required that he attend to the possible effects of peer discrimination. It was a "judgment call" on how far to push a student in

public. He had to make a good guess determining what students can or cannot manage in a middle school classroom setting.

Jeff wanted to push Sammy towards the “highest question” he could answer, “to pull it out.” He was intent on making Sammy to “work just a little bit more.” Yet, he also didn’t want to hit a “frustration level” where performance would fail in front of peers in ways that might discourage Sammy from future participation. If his special needs students couldn’t answer a question, Jeff acknowledged scaffolding with occasional “watered-down” questions to reduce the complexity of the inquiry. Sometimes he advanced higher questions and other times he pulled back with easier ones based on student comfort zones and the quality of their contributions.

This constant tension between pushing forward and pulling back based on individual and group reactions generated some unpredictability in Jeff’s practice. In a December interview, he first characterized this uneasiness as “treading on that line”- a line that required him to balance motivation and expectation with pedagogical dexterity. Treading was Jeff’s experience of managing uncertainty. Repeatedly in his interviews, Jeff would describe treading as both a sense of discomfort and a type of resource to help him feel out how far a student could be pushed academically before becoming discouraged.

Jeff began his transition by treading. He cautiously tested out new talk moves within an instructional paradigm established from years of professional experience. His original intent was to use these moves to scaffold Sammy’s participation. When the outcome also strengthened his curricular intent because

Sammy provided a unique contribution that “fit” the lesson goal, the positive feedback further aligned the new move skills to his existing teacher’s repertoire.

EARLY INTEGRATION PHASE

To press for Brandon’s confidence:

Integrating wait and press moves in scaffolding

What happened in the video: A dilemma with Brandon

By mid-March, the student composition in Jeff’s classroom had changed. In a span of two and a half months, he lost one student, received four new ones, and increased his number of special needs students to six. The most recent newcomer had joined his class exactly a week earlier, a student with multiple “severe” accommodation and service needs in his IEP plan. On the day of filming, Jeff admitted feeling a tad flustered. A “just hired” inclusion specialist was also in the room observing his class, a visitation that he did not learn about till right before the period began.

The class was studying a physical science unit about forces and motion. The debate topic centered on skateboarding accidents and whether the steepness of ramps affected the impact of a crash. To participate, students presented and argued their claims on what affected the impact using findings from a lab experiment. The day before student teams had conducted a series of lab trials, using a ruler ‘ramp’ to roll a ball into a cup. The tilted ruler was elevated at various levels of steepness using stacks of books, and for each elevation, the

teams measured how far the ball pushed the cup at point of collision. Testing the elevated condition three times, students averaged and recorded the measurements on a graph. Jeff spent much class time reviewing how averages and graph plotting were types of scientific evidence. He was concerned that “the math got in the way for a couple of the kids,” and this would hinder them from constructing evidence out of numerical findings.

Brandon was one such student who concerned the teacher. Tall and lean, he was a special needs student who was always attentive and engaged in lesson activities. Brandon collaborated on a team with Sammy and Jane, a girl identified as a “general ed kid.” During small group work, they discussed and concluded that steepness did matter. Their task was to craft a strong argument based on measurement evidence from the plotted graph. The team wrote a claims statement and selected Brandon to represent them. When Jeff requested a volunteer to launch the debate, Brandon immediately raised his hand:

Event 2.1: Dilemmatic event with Brandon – First response attempt

- 19 **Brandon:** I claim that the steepness of the ramp impacts on how fast the ball rolls.
 20 **Teacher:** Thank you. Can you prove that?
 21 **Brandon:** Yeah.
 22 **Teacher:** You can?
 23 **Brandon:** The data.
 24 **Teacher:** *Prove* it then.
- 25 **Brandon:** On, um, condition three - it's the highest because it is on - yah, 23. And
 26 the rest - the second condition is on – the second condition is on 21.5.
-

Brandon's voice trailed off. He moved his finger across a plotted graph in his lab book and paused, unable to find the correct spot to report. Sitting besides him, Jane whispered "No, it's right here," and pointed to a column under his fingers, showing which height measurement corresponded to the average of condition two in the experiment. Brandon retraced her movements with his pointed finger but quickly stopped again, whispering back that the graph was confusing.

During the whispered exchange, Jeff paused at the whiteboard for 5 seconds. He intended to meet the science curricular objective of teaching students about momentum and helping them understand how evidence is used to build a claim. Later in the interview, he would share feeling the strain of pausing the debate when there were five other teams that needed to present their claims too. But he wanted especially Brandon to explain his team's justification. Jeff once again faced his teaching dilemma between content and participation, requiring him to move in new directions.

Analysis of Jeff's instructional response to Brandon's confusion:

Turning peer repairs into scaffolds

In the next sequence of turns, Jeff employed a *diagram* and *peer repairs* to support Brandon (Lyster & Ranta, 1997) by turning visual aids and Jane's error corrections into scaffolds. Jeff began by *pressing* on Brandon's thinking, pushing him to "prove" his reasoning (line 24). But when Brandon struggled to construct the justification, the teacher turned to scaffolding. Jeff drew at a large T-chart.

Under one column, he wrote '*Height*' and on the other, '*Distance*,' to visually demonstrate the correct placement of each measurement. He then asked Brandon for the specific measurements of condition two:

Event 2.2: Dilemmatic event with Brandon – Second response attempt

Teacher sketches a large diagram. Jane and Brandon are whispering to each other. Brandon points to two spots on the graph. Jane moves her finger into Brandon's lab book and points to a spot on the opposite end of where Brandon was pointing.

27 **Teacher:** How tall is the second condition, please?

28 **Brandon** (*Looks up to face the class*) Okay, the height of the ramp is 8. And then. These are the -

Brandon stops abruptly, looking confused.

Extended pause of 16 seconds. *During the gap in dialogue, Jane continues to whisper to Brandon.*

29 **Teacher:** Ok, Brandon, I'm still waiting for you. Go ahead big guy.

As Brandon and Jane worked on interpreting the graph, Jeff used two types of moves to accommodate Brandon's reading difficulties and sustain the flow of the dialogue. First, he continued to *press* for evidence but simplified his initial request by asking for a concrete height measurement (line 27). This scaffolding strategy broke down the process of building a whole justification statement into discrete steps, beginning with one reported finding.

He then paused at the white board for 16 seconds. Jeff *extended wait-time* for the team to sort out their problem quietly. After Brandon still struggled with articulating his piece of evidence (line 28), Jeff announced he would wait for Brandon's input (line 29). This second move not only continued to press on

Brandon for an elaboration, it broadcasted to the rest of the class the teacher's decision to pause the debate even longer. Jeff tightly controlled the pacing of exchanges in order to provide Brandon extra time to read the plotted measurements. He held the 'floor' for Brandon to speak.

In the next discussion sequence, Jeff chose not to repair the error himself. Instead, he waited and allowed Jane to help Brandon's third attempt at reformulation:

Event 2.3: Dilemmatic event with Brandon – Third response attempt

- 30 **Brandon:** So the height of like the books that were stacked on is um 8 cm, and
 31 then um on trial one, it has the highest because it is 20 point -
 32 **Jane** (Whispering) Trial three.
 33 **Brandon:** Um, trial three is the highest because it is um-

Pause of 1 second.

- 34 **Jane:** (Very softly to the teacher). He's confused.
 35 **Brandon:** I'm really confused.
 36 **Teacher:** Ok, a little confusion. No problem.
 37 **Jane:** Okay.
 38 **Teacher:** Group can you pull it together for us? He made a claim that the height makes it go really fast. The height of what?
-

Brandon stumbled a third time and spoke with a stressed demeanor (line 33). After Jane and Brandon both requested teacher aid by reporting that Brandon was "confused" (lines 34 and 35), Jeff invited the whole team to craft the justification. This third move, a *nomination* for other speakers (Mehan, 1979), authorized other team members to *rephrase* Brandon's attempts and quickened the pacing of the discussion for other students in the class.

Jane immediately responded with two rephrased evidence statements. Jeff then asked Brandon to provide the final piece of evidence:

Event 2.4: Dilemmatic event with Brandon – Fourth response attempt

39 **Jane:** The height of trial three is 13 centimeters and it has the highest average
40 which is 23.

44 **Teacher:** Ok, I'm following this now.

Teacher writes the reported measurements for trial three on the T-chart.

45 **Jane:** And condition two, the height was 8 and it was a lower um average
46 which was 20.83.

47 **Teacher:** Thank you.

Jeff continues to write measurements for trial two.

48 **Teacher:** Brandon, can you please continue now?

49 **Brandon:** And then, in condition one, the height was 4 cm and then the average
50 was 13.66.

51 **Teacher:** Okay that was a nice recovery. Are you unconfused now?

52 **Brandon:** Yes.

53 **Teacher:** Okay, you got it man! You're in business! Thank you. So I understand
54 you made a claim and then backed it up with some real numbers. Would
55 anyone else like to make a claim similar to what the first group reported?

In this sequence, Jane accurately reported corresponding height and distance units in two trials (lines 39 and 45). Jane's coherent contributions served as peer repairs that modeled for the whole class how to pull measurements together into a justification. Her responses acted as sentence stems for structuring evidence statements. Sentence stems lifted away Brandon's extra burden of figuring out how to formulate a response and instead, allowed him to focus on reading the graph correctly. As Jane was reporting, Jeff filled out the T-

chart to visually differentiate each set of measures. Both visual and verbal resources were tapped to turn peer repairs into scaffolds.

Jeff's next two moves supported both Brandon's learning needs and those of the class. He returned back to Brandon for the last piece of evidence (line 48). His persistent pressing provided a fourth opportunity for Brandon to reformulate his evidence statement after many types of scaffolds were demonstrated. When Brandon succeeded, the teacher complimented him on his "recovery." At the same time, Jeff attended to the overall lesson goals as well. He summarized to the class that Brandon's team used "real numbers" to "back up" a claim, reinforcing the curricular intent. He then elicited "similar" claims from other teams (line 55). These moves maintained the topic flow and connected other team findings to the contributions offered by Brandon's team. Through wait and press, Jeff integrated Brandon's participation needs and the learning objectives

How the teacher perceived the event: Why Jeff waited

In the interview, Jeff recalled noticing two characteristics about Brandon, his struggle with numeracy and his eagerness to engage with the debate in spite of "stumbling." He observed that Brandon "didn't know how to report out" because "he's getting balled up with the numbers." Jeff assessment led him to believe that the primary learning problem was in reading the graph. Not reading correctly the graph points correctly hampered Brandon's ability to synthesize the information and formulate a formal proposition.

At the same time, Jeff noted Brandon's earnest efforts at reformulations. Brandon didn't get it right the first time but he thought the response was "close

enough.” Watching Brandon attempt at a second response in the video, Jeff stated (See juxtaposition chart in Appendix E):

So he stays in there. He hangs in there. Needs to get himself out of it.

He sensed Brandon was aware of making errors even as he spoke, “hanging in there.” But Jeff pointed out that Brandon still “stays in there” trying to put together a statement. Although Brandon’s response was incoherently expressed, Jeff saw in it the actions of a motivated student eager to correct his own mistakes. He also determined that Brandon was “close,” or at a point where he was figuring it out.

Jeff assessed the level of Brandon’s skills and engagement with the task. He noted what Brandon could not do and what he could do. These two observations encouraged Jeff to wait. He explained his decision simply as:

“I wanted to stay with him.”

As in the dilemma with Sammy, Jeff explained his reason for waiting as an act of “not giving up” on Brandon. He later elaborated that Brandon “needed me to not switch off on him.” His observations led him to believe that Brandon could decipher the graph if given enough time and scaffolds. Waiting gave Brandon another chance to work out the problem.

Another kind of wait: Allowing peer repairs to unfold

In both Sammy and Brandon's cases, Jeff described waiting as a desire "to stay" with each student. But unlike in January when he waited only one second, in March with Brandon he extended his wait time. After Brandon's first attempt at articulating a response, Jeff waited 5 seconds and then after the second attempt, he waited 16 seconds. Jeff performed what is defined in the research literature as an extended wait time – more than 3 seconds (Tobin, 1987).

In Brandon's case, Jeff felt he could wait longer because Jane "appropriately" took over the difficult situation:

At that point, I chose to wait and then I didn't have to do anything else because Jane took over. So she's that comfortable so that says what she thinks about me. She could say in, speak in.

Jane could "speak in" and momentarily release the teacher from being the sole person responsible for fixing classroom errors. Together, teacher and classmate could support Brandon.

Later, Jeff used the pronoun "we" to emphasis this joint effort in scaffolding:

He's trying to do it. I'm sticking with him, not giving up on him. The general ed kid's giving him some help. We're trying to scaffold as best we can here.

Unlike January when Jeff only used teacher repairs to scaffold Sammy, he now enlisted peer repairs as well to increase participation of a student with special needs. In waiting to allow for Jane's repairs to take effect, Jeff moved a slight distance away from his typical mode of direct teacher control in advancing a classroom discussion.

Why Jeff pressed: The benefit of pushing just beyond the comfort zone

Jeff described his questioning approach toward Brandon and Jane as a graduated system of scaffolds. He began with a higher-order question and if that didn't work, he "tried to help by asking leading questions," ones with embedded hints. Similar to Sammy's case, Jeff felt he had to give Brandon a "reduced question," one that was less complex. He needed to give Brandon "a little bit of slack":

So I was trying to-- well, I was controlling the situation because I was giving him the time, but I was trying to build some questions downward so that he could answer correctly and-- but I gave him a little bit of slack so that he could, you know, go with it.

The reduced question was both supportive and challenging to Brandon with his particular set of learning needs. Jeff worked towards finding the right balance of easy and difficult questions. Once again, Jeff 'treaded that line' between exerting and easing pressure on the performance of his special needs students.

In contrast to January, however, Jeff expressed more exertion than easing of pressure on Brandon when he pressed for justification. He referred to his request for Brandon to make the last evidence statement (line 48) as a form of a "test" (See juxtaposition chart in Appendix F):

I'm testing him. I want him to come back into the conversation. I had the feeling that he got it.

Jeff chose to press and later stated he risked it because he "kind of read that he [Brandon] was getting it."

By spring, Jeff felt he knew those students who have been with him since

fall, and they "each have a familiarity" with his teaching style. Typically, Brandon was a tenacious boy who "might make a mistake but [is] going to be right there for you within the same couple of minutes." Such a learner disposition enabled Jeff to push a little further beyond the student's immediate comfort level.

But there was another reason why Jeff exerted more pressure. He pushed farther to instill confidence. In the best of outcomes, pushing cultivated self-efficacy and resilience:

He needs that confidence. That boy, that young boy needs that...These kids need to be able to go out there on their own next year and learn in a new setting and I want them to walk into that classroom saying, "I am a student. I've had good experiences in my education thus far, at least in sixth grade. Now I can go into seventh grade and I can be confident and I can learn there."

Jeff reportedly pressed only when he sensed that Brandon could handle being pressed in public and was supported by enough scaffolds. Additionally, he believed that some pressure on his students with special needs developed their self-confidence. Not pressing would have suggested that they could not perform what other general education students were able to do. Consequently, while Jeff shifted backwards on his stance during a wait, he simultaneously pushed forward to press on Brandon's thinking. Waiting and pressing, he integrated the two moves.

The Early Integration Phase:

Scaffolding differently through skillful integration of new talk moves

In March, Jeff was still scaffolding his students with special needs into a classroom discussion but his scaffolding techniques looked very different from in January. He was able to perform and integrate two reform-oriented moves during a dilemmatic event with Brandon. Two differentiations can be drawn about the integration phase in Jeff's development. The first concerns the classroom climate in which Jeff worked in and the second pertains to his proficiency in using wait time and questioning strategies.

Jeff was more willing to risk applying new moves when the classroom climate turned positive. In a June interview, Jeff watched over again the video clip of Brandon and Jane. When asked what he thought was happening to his classroom environment by March, he responded that although there was a "new configuration of students," the "group was starting to gel." He further clarified:

Well, when it's starting to gel, that means that they can learn from each other, they can challenge each other, they can ask, "well, what do you mean by that?" – without the other person being offended. And say, well that doesn't explain anything to me. You know, or that kind of a statement. They'll come back and, "Well, this is what I really mean." Back and forth. They'll have that kind of a personal exchange where before at the beginning of the year, they might be offended when somebody would say to them: 'What do you mean by that?' You know: What do you *mean*, 'what do you mean?'

So I think that the kids are willing to converse more effectively with each other when they're gelling.

Jeff assessed that the class was at a point where students came together. They perceived academic inquiries not as personal attacks but as appropriate interactions during a class discussion. Students could critique and engage with

one another respectfully and safely.

Jeff stated that within this classroom environment, students helped each other. He pointed out Jane as an example in the video of a student helping another. When Jane “took over” with her peer repairs, he could choose to wait longer. A secure, friendly classroom climate not only helped students to converse effectively with each other, it helped Jeff enact more sophisticated forms of scaffolding. To transition into the integration phase, Jeff also needed to work within a responsive, constructive student environment.

Another differentiation from January was Jeff’s more skilled performance of waiting and questioning. Not only did he extend his wait, he pressed for Brandon’s justification, a combination of moves documented to be effective in producing coherent student responses (Maroni 2011; Rowe, 1974). Jeff moved from rephrasing a test question in the alignment phase to pressing for an elaboration during integration. His increased skills were not just a matter of improved execution in techniques. His technical dexterity was also an expression of “knowledge-in-action” (Schön, 1983). Jeff attained newfound knowledge in increasing the participation of students with special needs in his classroom discussions. He became more skillful at integrating new moves with his intention of scaffolding precisely. He was trying to find that right balance of easy and hard questions targeted at Brandon’s abilities. Waiting and pressing, Jeff was pulling and pushing just beyond Brandon’s comfort level, aiming for the zone of proximal development (Vygotsky, 1980).

Experiencing the pull and the push: Treading on the line with the class

It's important to document, however, that Jeff's experience of the dilemma was not necessarily an easy one, and the concurrent wait and press moves felt stressful to perform. The whole experience was "uncomfortable," a process that Jeff recalled by saying: "I suffered through it." Although he described stepping aside for Jane to help Brandon, he also recalled being fully attentive to possible negative outcomes:

Here in this sequence I'm the instructor pilot. My hands are off, but I'm right there. My hands are not far away from that steering wheel. I'm ready to take the controls back. He's [Brandon is] flying the plane. Jane's flying the plane. But I am closer to retaking control.

Holding back, Jeff was unsure at that point whether the main curricular objective would be met, "the specified goal of pulling the data out or analyzing the data." He was ready to intervene should Brandon fail. It was an uncertain moment for him.

Furthermore, the rest of the class sat at the edge of his awareness even as he focused intensely on Brandon and Jane. He described the experience as a 'balancing act' juggling between students of different ability levels:

I've got three or four others that are like, "Look, we know the answer. We know what he's trying to say." So imagine now, they're - see if this makes sense - quietly interacting with you and they're part of that sequence...So it's a balancing act between keeping those who are fully attentive and fully understanding what's happening with those who really need their minute in the sun.

Jeff characterized this discrete interaction between himself and the class

as forming an "agreement." Although the other students were not directly interacting with the speakers, they could support or hinder the instructional intentions to scaffold Brandon. Jeff asked himself, "What's their tolerance for him and me?" Sticking to Brandon required other students to be as patient and sensitive as Jeff himself, stretching their social emotional ability to be supportive of a fellow classmate. In Jeff's descriptions, wait and press moves also functioned as channels to retract and exert classroom control. Testing one student's capacity also stretched everyone else's limits in the room.

Enacting wait and press moves thus effectively required a sensitivity to the whole class. Jeff looked "with one eye," glancing for evidence that the others were "still engaged in that conversation." Gestures such as "looking" and "nodding" with Brandon conveyed to him that the other students were willing to accommodate Brandon's "minute in the sun." This also encouraged Jeff to hold onto a longer pause and press. In the integration phase, Jeff managed to take risks with his teaching.

TRANSITIONAL PHASE

To attain a peaceable conversation: Transitioning towards facilitation

“I’m not doing anything. They’re carrying on the conversation.”

Jeff’s voice was full of delight as he watched the final videotaped lesson (See juxtaposition chart in Appendix G). The footage, filmed in May, zoomed in on several general education students listening attentively and critiquing the contributions given by two students with special needs. The class was studying a unit about scientific hypothesis testing. The goal of the lesson was to understand how to write a good procedure for testing a hypothesis.

Jeff was pleased with how far his students had come. He pointed out a “peaceable conversation” in the video, one where students were “respectfully listening and speaking to each other” without several students “want(ing) to get in on it at the same time.” It didn’t happen too often on its own, but Jeff was glad that such conversations did occur. While Jeff still maintained a strong control over topic and turn-taking exchanges, he believed that by the end of his second year of implementation, he could act more like a facilitator. His role during peaceable conversations was “just to bridge it to the next kid, to the next group.”

The following excerpt demonstrated one of the moments that Jeff observed his students “carrying on the conversation.” Prior to the class discussion, the students were grouped in small teams. They huddled around their *Word Generation* lab books, giggling and critiquing a cartoon depicting a set of humorous, imprecise steps for making a peanut butter sandwich. Students then wrote their own sandwich-making steps, aiming to be detailed and structured in

their revisions. When the teams regrouped as a whole class, two students with special needs volunteered their revised procedures. The first speaker was

Sammy:

Event 3.1: A peaceable classroom discussion

05 **Teacher:** Can I have a volunteer or three to read their procedures out loud? We're
06 going to be listening and kind of analyzing in our minds to say: "Can this
07 really work?" All right I'm going to go with Sammy for one, and we'll try
08 Timothy next. Go ahead Sam.

09 **Sammy:** To improve -

10 **Teacher:** A little louder please because I've got a fan blowing here and I can't hear
11 you too well.

12 **Sammy:** To improve a peanut butter-sandwich-making procedure what I put for
13 step one was get some bread and open it. Step two was put it on a plate.
14 Step three was get the peanut butter out of the cabinet. Four was open
15 the jar. Five was get a butter knife. Six was spread it - spread the peanut
16 butter on the two pieces of bread. Then put the two pieces of bread and
17 put them together. Then if you want to, you can take a knife and cut it.

18 **Teacher:** Thank you very much for your work. That was good hard work. Did
19 everyone follow along with that?

20 **Several student voices:** Yeah. Yeah.

21 **Teacher:** Okay, did anyone find a problem with that? Is there anything you might
22 add or subtract?

Several students raised their hands.

23 **Teacher:** What do you think about that Jasper?

24 **Jasper:** The peanut butter - the peanut butter part? Well, like he got the knife but
25 he didn't tell anything to like get the peanut butter out with the knife and
26 then spread it.

Jasper pantomimes with his pencil as a knife reaching into a jar and then spreading peanut butter on a slice of bread.

27 **Teacher:** Ahh! So he told us to get the knife but he didn't tell us to use the knife to
28 spread the peanut butter. Ahh, so he might have a clean knife at the end.
29 You might have a nice peanut buttery hand at the end.

Sammy bursts out a giggle. Then the whole class including the teacher laughs.

In the exchange, Jeff invited the whole class to analyze Sammy's procedures (lines 21-22). Jeff's questions were open invitations, seeking responses without preconceived notions of how to evaluate Sammy's revision. He solicited Jasper, a general education student, to critique Sammy's contribution (line 23). The exchanged turns between Jasper and Sammy were carefully teacher-controlled and the conversation did not lead to extended student turns, such as a response from Sammy to Jasper's critiques. However, compared to earlier in the year in the case where Sammy shared his idea for model limitations, other students were now encouraged to think about and interact with Sammy's ideas.

A dilemma at ease: Balancing content and participation

In the interview, Jeff marveled at how much his students' communication skills developed. Particularly, he felt "just so proud" of Sammy who "made a nice change this year." Jeff remarked:

Did you hear the number of steps he had? I mean, maybe he left a word or two out, but he really kind of-- but I thought it was well done...he used to have an idea in his mind [and] couldn't get it out. But now things have regulated and he can say what he really is thinking and often times he's right on the money.

Jeff noted gravely that Sammy still struggled with composing his ideas in writing. At this point, Sammy's success was "all oral" but Jeff believed that getting "the idea that was in his head out" was "step one."

Jeff thought two aspects of the discussion boosted Sammy's participation.

The topic of making peanut butter sandwiches was familiar and within students' "comfort zone." The topic was "definitely an appropriate, engaging activity for them" as "it was something they had the ability to recognize and talk about instantly." Additionally, his students had more science background to figure out what the objective of the science activity entailed. Having worked with procedures such as setting up a microscope in science class, the students "knew enough to include fine details" and "sequencing words" in their revisions. They could easily talk to one another now that they have more science background to understand problems posed in the curriculum and the topic under discussion involved a task they were familiar with. At the end of the year, the discussion curriculum offered an "appropriate" activity for his inclusive students who by now have enough science experiences to have a peaceable conversation with the rest of the class.

Jeff was not yet leading dialogic discussions with his students. But balancing both content and participation needs, he experienced transitioning into the role of a facilitator.

Alignment and integration in skills acquisition

Jeff was a transitional teacher learning to shift his teacher talk away from content dissemination and towards facilitation of student exchanges in an academic discussion. He moved toward this new role through a process of integration, one in which newer and existing talk strategies came together to meet content instruction and participation goals. In Jeff's case, performing hybrid practices was not simply a matter of being pedagogically pragmatic. It was reflective of a change in how he used classroom talk to scaffold and promote student learning.

The impetus for this change began with a dilemma that repeatedly surfaced in Jeff's teaching in the context of a discussion-based curriculum. Whenever his students with special needs struggled to provide a coherent contribution, Jeff wanted to simultaneously scaffold an appropriate response and move the discussion along, developing students' content knowledge and argumentative skills. It was his students and their particular learning needs that provided the catalyst to shift Jeff towards a more reform-oriented pattern of classroom talk. Essentially, this dilemma served to be the 'liminal space' for Jeff to develop more complex forms of teaching practices.

More than once, Jeff experimented with wait and press moves to manage his dilemma. The performance of these moves and Jeff's descriptions about them differed over the course of filming. These differences can be summarized

as phases in Jeff's acquisition of new dialogical knowledge and skills (See Exhibit A on page 99). A key difference at each phase is how Jeff employed wait and press moves to ease or exert control over participant interactions. As his dexterity in these newfound skills advanced, Jeff took the risk of becoming less teacher-directed at "teachable moments" when he sensed easing control would promote student achievement.

Jeff first applied what he thought were wait and press moves to Sammy's learning challenges in January. He enacted waits of one second in duration and used a series of teacher repairs. Jeff interpreted waiting as an extension of scaffolding, a decision to hold still and resist the temptation to move to another student's response until enough supports bolstered Sammy's ability to respond coherently. Likewise, he rephrased his original test question in different ways in hopes that one would "stick," a repetition strategy that also scaffolds. At this phase of transition, Jeff found an alignment between his scaffolding paradigm and the newly introduced dialogical knowledge. The alignment and Sammy's successful outcome prompted further explorations of alternative talk strategies.

If Jeff had stopped at alignment, the case of his transition may have resembled that of Ms. Oublier who taught new math using traditional approaches. But by mid-March, Jeff began to perform waiting and pressing differently. When Brandon could not produce an evidence statement from a graph, Jeff sustained an extended wait twice, one at 5 seconds and then another at 16 seconds. He then paired the wait with continued presses on Brandon to give reasons for his scientific claim. Jeff not only waited longer, he also moved from rephrasing to

pressing questions. This placed considerable pressure on Brandon to deepen his thinking beyond his initial simplistic answer.

The scaffolds Jeff employed also differed. In contrast to January when Jeff only used teacher repairs to scaffold an answer, he now relied on peer repairs and a visual diagram to guide Brandon towards an evidence statement. The diagram deconstructed the task into discrete components while Jane's repairs modeled how to construct evidence from numerical findings. Comparatively, these scaffolds were more complex than teacher repairs because their enactment required Jeff to manage many dimensions of content learning and participation at the individual and class levels. At this point in the school year, Jeff's classroom community came together, and students were more comfortable with critiquing and supporting each other in an academic discussion. The positive classroom climate allowed Jeff to risk even more in experimenting with complex talk strategies that he was uncertain at first would be successful.

Integrated into the scaffolds, the wait and press moves helped Jeff negotiate these tensions between teaching for different intentions and at varying levels. For example, Jeff worked in tandem with Jane's repairs to make learning happen, actions necessitating a precise timing of when to release control for Jane to "take over." His extended wait moves allowed Jane's repairs to emerge and supported Brandon in developing an evidence-based statement. As Jeff controlled classroom interactions to sustain Brandon's participation, he also highlighted the critical points of the lesson, especially the importance of backing up a claim with evidence. After pressing for reasons, he organized responses

inside a visual diagram to further elucidate the process of extracting numeral data as findings for the whole class. Not only did the scaffolds and pressing bolster Brandon's ability, they advanced everyone's learning.

Thus, in the phase of early integration, not only did Jeff's skill in waiting and pressing sharpen, his set of scaffolding skills also diversified, increasing his instructional effectiveness. When Jeff integrated more dialogical talk skills into his teaching repertoire, he did not just retain his old practices in hybrid teaching. Rather, his prior scaffolding expertise became more sophisticated when he maximized other types of resources, such as peer repairs, to promote learning. For instance, waiting for Jane's repairs required a fundamental shift in his engagement with classroom control. He had to develop a tolerance for tapering the degree of direct teacher control over student interactions. Jeff's teaching practices evolved to handle more complexity within a discussion, in both new and old ways.

Transitioning to meet at student zones of development

A critical component in this shift is Jeff's facility with managing his uncertainty. Although elated with the positive outcomes of his students' performances, Jeff shared the "uncomfortable" feelings he had applying wait and press moves. On the individual level, he apprehended how long to wait, pulling backwards with minimal interference, and how much to press, pushing Sammy and Brandon in front of their peers. He was aware that too much force could

frustrate them but too little would not develop their academic potentials. At the class level, he paced a discussion to “not lose momentum” for the rest of the students even as he paused a debate to support individual learning needs. Jeff was constantly “treading,” or monitoring the right amount of exertion and retraction of classroom control. His feelings of uncertainty became a resource for him to sense the right degree to push or pull in a teaching situation. That is, his sensitivity to the tensions allowed him to approximate the right zone of development for his students.

Jeff was already experienced with finding an individual student’s zone of proximal development (ZPD). His initial dialogues with Sammy about model limitations demonstrated his expertise with questions that Tharp and Gallimore (1988) defined as “those that *assess* and those that *assist*” (p. 59, italicized by author). Analyzing within the ZPD framework, questions that assess are evaluative questions used to check what level the learner is at in performing without assistance. These questions resemble those test questions that proliferate in recitation scripts. A question that assists, however, “provokes creations by the pupil” (p.63). Jeff’s clarifying question, functioning as contingent instruction, followed Sammy’s line of thinking to assist his entry into the class discussion and support Sammy’s capacity to elaborate on his own ideas.

However, in a discussion setting, Jeff had to maneuver through multiple zones. In these expanded social interactions, Jeff had to push or pull back depending on a number of student reactions while advancing his instructional intentions. He described his orchestration of moves at the class level as following

the “ebb and flow” of constantly changing class dynamics:

Classrooms like all of life go through... tidal changes [or] energy shifts. I see the classroom undergoing this kind of a shift each period...No two periods or days are alike due to the complexity of the human variables comprising the equation.

I see myself as a set of "retractable training wheels" constantly sensing when to deploy, and when to retract in that setting.

Talk moves like waiting and pressing gave Jeff alternative techniques to deploy or retract classroom control, movements that could elevate student thinking and support emotional needs. He operated within a continuum of teacher-directed and student-centered moves, learning to edge towards the latter as his ability to find the right zones progressed and his students “gelled” in their relationships with one other, offering a more trusting climate in which to learn from errors. At the heart of applying an extended wait and an effective press is Jeff’s evolving knowledge of when to be more teacher-directed and when to step aside for learning to emerge during a discussion. Becoming a transitional teacher was the act of being responsive to many zones and levels of student learning, exerting or distancing from direct control to attain the right level of pressure in advancing student development.

Jeff entered into this transitional phase, more aware of how different patterns of classroom talk foster and control student learning. His entrance was partially guided by the wait and press moves, a set of technical strategies that served as threshold skills to navigate through the liminal space of his dilemmas. Though they started as strategies to help solve his dilemma, the threshold skills became channels for Jeff to develop a deeper awareness of dialogic instruction

and to further his scaffolding expertise.

At the end of his second year of implementation, Jeff did not fully transition into being a dialogic teacher. But the two strands of development aligned and began to integrate, leading Jeff to a conceptual threshold. He was discovering that it was possible to reach his dual intentions of content learning and participation goals, even when he was “getting off center stage.” His own awareness of this change was captured in his reflections at year-end:

I have become a little more comfortable taking that backward seat and just stepping away in *Word Gen* and in my other classes too. I’m the facilitator.

Becoming more integrated, Jeff transitioned.

Appendix A

Selection of codes that describe teacher intentions and reported experiences of talk actions

Parent Code: Teacher Intentions to monitor participation			
Code	Code Description	Anchor	The Anchor Context
Vocalize	Teacher describes the intention to give other students a turn	JT: Cuz I saw Israel and Isis going back and forth, back and forth, and I was like they don't even have a chance to talk yet. You know, so <u>I wanted to make sure that they can share out their their perspectives as well...and make sure they had a voice too.</u>	JT explaining why she interfered and cut two students' contributions short.
"Back and forth"	In Vivo: When a teacher describes the intention to get a flow of discussion among students	KV: I think I was still thinking – can I get this into a – I don't want to say debate, but I was hoping that- I know that group with that girl. I knew that hers was very different. So I was hoping without having to call on her for her [to] say "Actually, mine was very different," you know what I mean? To be able to have a conversation that goes back and forth.	KV sharing what she was thinking privately while students shared their lab observations in a large circle. In this specific instance, two girls claim they agree on the same observation even though KV noticed that their lab reports showed differing observations.
Invaluable	Teacher describes the intention to show	JL: So, out of needs-wise in this group, I think the only one who is like a little	JL introducing the students in his small group and his sense of

	<p>students that their contributions during discussions are appreciated and invaluable.</p>	<p>bit needy would be Jose in the sense that even though he's non-- not as verbal as the other students. <u>He needs to be shown that he's still a helpful member of the group even though he's not participating loudly,</u> you know. So, I try throughout the whole thing ask him questions and you know, he might smile and give me one of these. But, as long as he knows that <u>his input is valuable,</u> you know, kind of thing so.</p>	<p>what their needs were and consequently, why he interacted with them the way he did during small group talk.</p>
<p>“Task at hand”</p>	<p>In Vivo: Teacher describes directing student attention to “the task at hand.”</p>	<p>JL: I think throughout the whole thing my focus was keeping them focused on what the task at hand was.</p>	<p>JL summing up his instructional goal during the first social studies debate he and his co-teacher conducted together. He was referring to why he closely managed student talk in small groups.</p>

Appendix B

Selection of codes that describe teacher talk moves

Teacher talk ‘moves’ a discussion forward by:

- Externalizing student thinking
- Highlighting voices and participant contributions to encourage listening attentively
- Developing students’ own ideas
- Getting students to work with each other’s ideas

*Adapted from Snow & O’Connor (2012).

Talk moves that teachers use to move toward productive discussions

Types of Teacher Talk Moves	Description
Confirmation checks	Checks to make sure the teacher understands student contribution
Comprehension checks	Checks to make sure students understand teacher contribution
Clarification checks	Ask students to clarify their contribution
Turn completion	Finishing a student’s contribution.
Scaffolds	Teacher verbal scaffolds used to assist student learning of content and/or skills
Revoicing	Repeat a student’s contribution and rebroadcast it back to the class. May reformulate student utterance.
Rephrasing	Get students to restate their classmate’s contribution
Responding	Get other students to comment and/or evaluate their classmate’s contribution
Clarifying and listening to student thinking to develop ideas and acknowledge participation	

Types of Teacher Talk Moves	Description
Authentic questions	Questions that lead to open-ended answers. Authentic questions break up the traditional pattern of initiation/response/feedback (IRF) teacher talk.
Display questions	Questions where the teacher knows the correct answer and 'tests' students knowledge. Display questions are useful at the beginning of a discussion when teachers are setting up the background and expectations of the discussion or to check in whether students understood a teaching point.
Individual nominations	Teacher selects an individual student to respond to a question by verbal or nonverbal means (such as teacher gaze).
Invitation to bid	Teacher nominates a student to respond but solicits students to make themselves known whether they are willing or able to respond.
Invitation to reply	Teacher opens the floor, allowing students to respond without selecting any students beforehand
Elicitations that organizes content, develop concepts (both students' & curriculum), and structures participation	
No repair	Teacher ignores the error completely.
Teacher repair	Indicate an error has been made and teacher corrects it.
Student repair	Indicate an error has been made and get the student who made it to correct it.
Peer repair	Indicate an error has been made and get other classmates to help correct it.
Repair or error correction to support learning	

Types of Teacher Talk Moves	Description
Extended wait-time	A longer chunk of time that a teacher 'waits' for a student response to give students a chance to think about their response. Walsh (2011) suggests a length of 2 or more seconds in classroom of second-language learners is considered extended.
Extended student turn	A student contribution of several utterances without interruptions from the teacher.
Interruption	A teacher interrupting during a student contribution.
Overlap	A teacher and a student overlapping utterances.
Echo	Teacher repeats what s/he already stated.
Backchannel	Returning to an earlier part of a dialogue and/or a teacher bringing back a student's earlier contribution.
Just-in-time scaffold	Teacher support immediately right after a student contribution.
Front-loaded scaffold	Teacher support right before student contributions, usually right at the beginning or before the discussion begins.
Delayed scaffold	Teacher support after a delayed time lapse from student's original utterance.
Pacing teacher talk to connect ideas, encourage participation, and orchestrate whole class interactions.	

Compiled teacher talk moves from Cazden (2001), Bruner (1983), Mehan (1979), Nystrand (1997), O'Connor & Michaels (1996), Sacks *et. al.* (1974), and Walsh (2011).

Appendix C: What Jeff said about waiting for Sammy (Events 1.2-1.3)

Transcript of discussion video clip	Jeff's reflections on the video clip
<p>Teacher: Now we'll come back to the phrase here. There's some limitations to the parts of the model that you're using. Limitations mean – mmmm– not exactly as good as the real thing. So what are some limitations with the pieces of equipment that we are using today? We're using paper, tin foil, and we're using marker. How is that very <i>unlike</i> the real thing? (<i>Tilts head towards Sammy</i>) Yes?</p> <p>Sammy: Well. For one -</p> <p>Teacher: Speak a little loud so that I can hear. I need to just be able to hear you.</p> <p>Sammy: For one, if the reason you can't build it is because some of this stuff we made is already there. And because like a lot of other people are saying, we cant really put poison on the ground because you could get fined or something.</p> <p>Teacher: 'Kay. So. But you're not telling me why the materials might not work as well?</p> <p>Sammy: Because –</p> <p>Teacher: That's what I'm trying to get at. Can you tell me how the materials that we have in class might not work as well as real objects in life? <i>That's</i> what I wanted to get at.</p> <p><i>[Three other students immediately raised their hands high up in the air.]</i></p> <p>Sammy: Because the models aren't exactly like it. So there could be something different that happens than what would happen</p>	<p>Jeff: I'm glad that I stayed with him.</p> <p>R: I was going to ask that.</p> <p>Jeff: I don't like it when teachers go to one person, don't get the answer they want and then go to another person. It's like maybe he does know the answer and may be he's gonna feel frustrated because – now if he doesn't get out the first time doesn't mean he don't know it – 'Now I feel bad about myself.' So they try to teach us nowadays, you know - <i>wait time</i> - to stick with the kid and maybe rephrase the question, rephrase what you're looking for.</p> <p>R: So I was wondering why you stuck with this particular student and it's for that moment.</p> <p>Jeff: This little student needs a little boost. He needs to, he needs to get a hit, so to speak.</p> <p>R: Okay, okay.</p> <p>Jeff: If this kid didn't have a - I might say: "Hmm, it's not what I'm looking for" - I might have jumped. But for that one and well – there's an example someone I would have skipped right through. She is a girl, a woman, a young girl whom I would have said she gets enough right and has enough self-confidence that if she didn't get it right first time, no big deal. This guy is okay too, but there's a couple of kids –the girl sitting over in the corner, Ana and him and Sammy – I would have really wanted them to pull it out – until I feel like, alright I'm not getting anymore here.</p>

R is abbreviated for researcher-interviewer.

Appendix D: Jeff's reflections on Sammy's final contribution (Event 1.4)

Transcript of discussion video clip	Jeff's reflections on the video clip
<p>Teacher: Okay, here we go! I understand what he's saying. He's saying that if we decide to make a bumpy model compared to a fairly flat model it might be different.</p> <p><i>[Teacher sketches out a bumpy hill and a flat horizontal line on the whiteboard.]</i></p> <p>Teacher: For example on [name of local region] –we're trying to talk about the watershed on [local region], and we have used a very flat bedrock then it might behave in a way like real life. But if we made [local region] look like a mountainous region, then the model might not behave as it would in real life.</p> <p>Sammy: (Nodding) Yeah.</p> <p>Teacher: Bingo! I followed what you meant!</p>	<p><i>Researcher began questions after viewing the video clip.</i></p> <p>Jeff: Okay. Then he - Yeah. Good. He brought up a good point cuz I hadn't mentioned. I thought to mention.</p> <p>R: So you, rephrased what he said, in but in a way that the rest of the class understood or –?</p> <p>Jeff: They, the kids have never heard this before. So this was a teaching moment. He brought up a point that I hadn't included.</p> <p>R: Making sure the models fit the, local - the environment that you are trying to –?</p> <p>Jeff: That we're trying to replicate. If we made it pure [local region] model we know it would've been fairly flat. But there are parts of [local region] where there are some hills. And there is a - what's called a moraine. And then I think that I explained it to some girls over here, a little differently about that rise and the fall. About how people didn't really want to live near the dump. So they put the dump as far away from them as they could get it. It turns out to be the exact wrong place.</p> <p>R: Yes, later on in the lesson here.</p> <p>Jeff: So Sammy brought it up, I think I could even hear the excitement in my own voice here, yeah. Alright, "Here we go!" You</p>

	<p>know, this is, you know, it was a good point that he made, the greater the elevation, the greater the difference, the greater the change would be.</p> <p>R: So and you just called this a teaching moment. So it's a teaching moment because another student came up with an idea, that was -?</p> <p>Jeff: That fit. It was something I hadn't planned to include but I said: "Oh, this would fit." Actually I didn't say that, it just happened.</p> <p>R: Yeah. [<i>laughs</i>]</p> <p>Jeff: I didn't think that thought, it just happened. But that was nowhere in my notes to say that.</p> <p>R: And partly this occurred -?</p> <p>Jeff: Because of his response. Yeah. So that - that took us in a whole different direction. That's pretty cool.</p>
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R is abbreviated for researcher-interviewer.

Appendix E: Jeff's reflections on Brandon's first and second attempts (Event 2.1 and 2.2)

Transcript of discussion video clip	Jeff's reflections on the video clip
<p>Event 2.1</p> <p>Brandon: I claim that the steepness of the ramp impacts on how fast the ball rolls.</p> <p>Teacher: Thank you. Can you prove that?</p> <p>Brandon: Yeah.</p> <p>Teacher: You can?</p> <p>Brandon: The data.</p> <p>Teacher: Prove it then.</p> <p>Brandon: On, um, condition three - it's the highest because it is on - yah. And the rest - the second condition is on - the second condition is on 21.5.</p>	<p>Jeff: It's close enough.</p>
<p>Event 2.2</p> <p><i>Teacher sketches a large diagram. Jane and Brandon are whispering to each other. Brandon points to two spots on the graph. Jane moves her finger into Brandon's lab book and points to a spot on the opposite end of where Brandon was pointing.</i></p> <p>Teacher: How tall is the second condition, please?</p> <p>Brandon (<i>Looks up to face the class</i>): Okay, the height of the ramp is 8. And then. These are the -</p> <p><i>Brandon stops abruptly, looking confused.</i></p>	<p>Jeff: So he stays in there. He hangs in there. Needs to get himself out of it.</p>

<p>Event 2.2</p> <p>Extended pause of 16 seconds. <i>During the gap in dialogue, Jane is whispering to Brandon.</i></p> <p>Teacher: Ok, Brandon, I'm still waiting for you. Go ahead big guy.</p>	<p>Jeff: I wanted to stay with him.</p>
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Appendix F: Why Jeff pressed (Event 2.4)

Transcript of discussion video clip	Jeff's reflections on the video clip
<p>Jane: And condition two, the height was 8 and it was a lower um average which was 20.83.</p> <p>Teacher: Thank you.</p> <p><i>Teacher continues to write measurements for trial two.</i></p> <p>Teacher: Brandon, can you please continue now?</p> <p>Brandon: And then, in condition one, the height was 4 cm and then the average 50 was 13.66.</p> <p>Teacher: Okay that was a nice recovery. Are you unconfused now?</p> <p>Brandon: Yes.</p> <p>Teacher: Okay, you got it man! You're in business! Thank you. So I understand you made a claim and then backed it up with some real numbers. Would anyone else like to make a claim similar to what the first group reported?</p>	<p>Jeff: I'm testing him. I want him to come back into the conversation. I had the feeling that he got it.</p> <p>Jeff: [Chuckles] So, so I saw her do it, I heard that it was correct, I kind of read from him that he was getting it. I now needed him to feel some confidence. That's why I called on him for the third. She could've easily given the third one. So he came back. He walks away feeling: "I can do this!"</p>

Appendix G: Jeff describes facilitating a peaceable conversation (Event 3.1)

Transcript of discussion video clip	Jeff's reflections on the video clip
<p>Teacher: Can I have a volunteer or three to read their procedures out loud? We're going to be listening and kind of analyzing in our minds to say: "Can this really work?" Alright I'm going to go with Sammy for one, and we'll try Timothy next. Go ahead Sam.</p> <p>Sammy: To improve –</p> <p>Teacher: A little louder please because I've got a fan blowing here and I can't hear you too well.</p> <p>Sammy: To improve a peanut butter-sandwich-making procedure what I put for step one was get some bread and open it. Step two was put it on a plate. Step three was get the peanut butter out of the cabinet. Four was open the jar. Five was get get a butter knife. Six was spread it - spread the peanut butter on the two pieces of bread. Then put the two pieces of bread and put them together. Then if you want to, you can take a knife and cut it.</p> <p>Teacher: Thank you very much for your work. That was good hard work. Did everyone follow along with that?</p> <p>Several student voices: Yeah. Yeah.</p> <p>Teacher: Okay, did anyone find a problem with that? Is there anything you might add or subtract?</p>	<p><i>Researcher began questions after viewing the video clip.</i></p> <p>R: What was your role in this short clip to make the learning happen?</p> <p>Jeff: Right. Just to bridge one student to the next student as facilitator. They didn't - There was nothing I said that was really that intelligent or, you know, that added to the learning process. I was just kind of recouping what-- not recouping, reviewing, restating, re--</p> <p>R: Were you restating, you mean, with Sammy?</p> <p>Jeff: Restating what Sammy had said. Just to bridge it to the next kid, to the next group, and then from here I'm going to bring it to the next person. I'm only a facilitator.</p> <p>R: Okay.</p> <p>J: You know, I didn't really say anything that was that brilliant [<i>chuckles</i>].</p>

Several students raised their hands.

Teacher: What do you think about that Jasper?

Jasper: The peanut butter - the peanut butter part? Well, like he got the knife but he didn't tell anything to like get the peanut butter out with the knife and then spread it.

Jasper pantomimes with his pencil as a knife reaching into a jar and then spreading peanut butter on a slice of bread.

Teacher: Ahh! So he told us to get the knife but he didn't tell us to use the knife to spread the peanut butter. Ahh, so he might have a clean knife at the end. You might have a nice peanut buttery hand at the end.

Sammy bursts out a giggle. Then the whole class including the teacher laughs.

R is abbreviated for researcher-interviewer.

At the final research taping towards the end of the school year, the classroom discussions looked noticeably different from what we first filmed.

...Ms. Harmon's class was no longer sitting in a U-shaped arc. Her students were seated in clusters of small teams within easy access to each other. Booklets wide open, the students were analyzing together a one-page document about two teenagers fleeing war-torn Sudan.

By late May, Ms. Harmon had completed all science units and was no longer teaching Word Generation. When we asked to film her one last time, she "swapped" a Word Generation class period with the social studies teacher. In the session, she led a discussion about the types of ecological obstacles and resources teenage refugees might encounter as they fled their Sudanese village. Ms. Harmon stated she very much enjoyed conducting this discussion even though it was from a social studies unit. She was initially surprised by the level of challenging text which had "lots of big ideas packed into one paragraph." After students spent time conversing in their small groups, however, she observed that the class was able understood the packed information and had a productive discussion.

...The students in Mr. Corbett's class were debating how best to evaluate a procedure written by Maria, a fictitious student in a lab activity. The debate was not formally introduced by the teacher but emerged after students had a disagreement over the types of errors Maria committed in composing a lab experiment procedure. Although Mr. Corbett guided the debate, the students directed the flow of discussion by responding to each other's disagreements. In the interview, Mr. Corbett expressed delight in his students' ability to sustain these instances of "flowy" exchanges.

...By mid-June, Ms. Walter stopped using fishbowl debates in her classroom. Although students preferred this discussion format, the teacher was concerned that the lively student energy levels before summer vacation were not conducive to fishbowl debates. Ms. Walter moderated the discussion activities carefully, alternating seat work with classroom talk. Students wrote their claims quietly in pairs, individually, or with an adult teacher aide. Afterwards, they shared their ideas from assigned seats. Although discussion time was shortened and student exchanges were more structured, Ms. Walter reflected that students participated in classroom talk differently than early fall. Everyone by now expressed their opinions in class with reasons and sometimes, those reasons were supported by textual evidence. It had become the community norm in her social studies class for students to use evidence to support their agreements or disagreements in student talk.

The classroom talk captured in these final video clips are far from the descriptions of dialogic discussions elaborated in the research literature. Interspersed between student exchanges were many awkward pauses, off-tangent remarks, and heavy teacher interventions. After only a year or two of implementing a new discussion-based curriculum, one would not expect teachers and students to have conversations that represent ideal models of academic discussion.

However, while reflecting on videoclips of their own classroom discussions, teachers became aware of moments when student talk became productive. At the last interview, they compared student talk in the fall and spring semesters, noticing improvements in how students expressed ideas and interacted with each other. Although teachers were quick to point out that the quality of students' academic claims could be better or that students did not necessarily know how to write an argumentative essay, they thought the new curriculum overall promoted participation in discussions and fostered constructive student contributions. Seventh grade teacher Mrs. Owen reported that at first, she thought Word Generation was merely a program designed to increase vocabulary among middle schoolers. At the end of the year, she now valued the program for developing student skills in academic discussion.

Because teachers had to experiment with new instructional strategies to change classroom talk, the new curriculum also introduced surprises and dilemmas into teachers' experiences of implementation. Analysis of participant exchanges and teacher reflections suggested that teachers used more effective

talk moves when they managed their uncertainties. Essentially, they learned to respond to unpredictable student responses in a way that advanced student thinking. Surprises and dilemmas were important sources of experiential learning for the teachers in my study.

A few lessons can be drawn from these teacher cases and applied to professional development. In the next pages, I share what I learned about advancing the teaching craft under conditions of uncertainty. Since the six teachers-in-development utilized reflection to analyze their own experiences, my suggestions for professional developers and curriculum coaches also use reflection as a mode of inquiry for improving teacher performance.

Finding #1: Surprises are deeply informative because they reveal prior assumptions teachers have about student learning. At the same time, surprises highlight potential shifts in teacher understanding of how new curriculum advances student learning.

Lesson #1: Be aware of how surprises can trigger teacher learning. You can use a surprising incident to deepen reflection.

Pay attention to *what* surprises teachers when they try new lessons in their classrooms. Surprises can reveal the assumptions teachers hold about student learning and engagement. In the study, teachers were amazed by their students' capabilities in tackling challenging tasks. They were also pleasantly surprised when students eagerly contributed to topics that teachers initially didn't think

would sustain middle schoolers' interests. Teachers in my sample mostly reflected on teaching assumptions that underestimated adolescent abilities and motivation in academic discussion. Because teacher perceptions affect the quality of curriculum implementation, assumptions are important to apprehend in professional development. Teachers will modify curricular activities to accommodate what they perceive students can achieve (Cronin-Jones, 1991).

Also, listen carefully to *how* teachers describe their surprises. When the five teachers in the study described their experiences of surprise, they often made comparisons between what they typically see students do in class to what they observed happened differently in the new lesson. In cases where newer instruction methods led to positive student outcomes, these comparisons were useful in guiding teacher reflections on why students were successful. For example, Mrs. Owen noted that students who were usually reticent during whole class settings were more engaged and vocal in peer-to-peer group discussions. These contrasting observations made her thoughtful about how smaller group interactions benefitted "shy" students. When comparing, teachers use their own experiences of implementation to analyze how specific instructional techniques were effective.

Even when student outcomes were unsuccessful, comparisons aided teacher analysis. Mrs. Owen and Mr. Burns were unimpressed by one discussion format suggested by the curriculum. In this activity, students had to debate perspectives that were not their own and provide evidence for claims made by characters in the text. Although students studied and prepared to take on another

character's perspective, in the actual debate they struggled with responding to each other spontaneously using a perspective that was not their own.

Mrs. Owen stated at the interview: "We found the activity kind of clunky for our kids." She pointed out peer interactions that clearly indicated students wanting "to move beyond this format" towards expressing their real thoughts. She also clarified the more important academic skill that she wanted students to develop in the academic discussion, mainly how to use textual evidence to support claims. She elaborated how the "clunkiness" prevented students from basing their claims on strong evidence unlike the other discussion formats that were previously videotaped. Throughout her reflection, Mrs. Owen conducted intricate analysis of what discussion techniques were more effective for her students now that she had a range of experiences with different academic discussion formats.

Surprises help teachers filter through a sea of information in the classroom to detect an unusual pattern of student responses that affect learning outcomes. Change in perception is an important first step in teachers becoming more responsive to student thinking and dispositions. Professional developers can leverage this change in perception to support changes in instruction. In a sense, surprises highlight a teacher's zone of proximal development. We not only see how teachers have been assessing their students up to this point, but we also sense how their instructional responses can change when they identify new patterns of student learning.

Finding #2: Surprises can be delightful or disappointing. The positive and negative experiences associated with unexpected events shape instructional decisions.

Lesson #2: Because surprises are emotionally experienced, address delightful and disappointing events with sensitivity.

Surprises can be emotionally charged, affecting teacher motivation positively or negatively. When teachers examine their own surprises, it's important to address these feelings with sensitivity. Happy surprises in the study usually indicated a successful teacher move that enhance student outcomes. Happy surprises motivated teachers to further explore and implement academic discussions. But disappointing surprises disoriented teachers, especially when they observed student responses that challenged their teaching assumptions and expectations. They can be experienced as failure to accomplish one's instructional goals and discourage teachers from believing students can be successful.

One way to help teachers make sense of and learn from delightful or disappointing surprises is to connect the two divergent experiences. In one class period, teachers could encounter both positive and negative surprises, as Mr. Corbett did when his students unexpectedly failed to collect good data in an experiment. Disconcerted, Mr. Corbett initially did not think his students could hold a debate to identify four mysterious white powders. But his students surprised him a second time when they correctly named two powders in a productive class discussion.

Mr. Corbett related the two events by reflecting on why both types of surprises emerged in the same discussion. He reasoned that in the disappointing surprise, students worked on reporting experiment results individually and did not fully capture findings in their notes. Thus, each student lacked “pieces of the puzzle” to solve the powder mysteries. But when they worked together, they pooled their data sources to complete the task. Mr. Corbett thought this incident mirrored real life where scientists from different disciplines each had a part of a solution and needed to collaborate together. He concluded that what made a difference in students’ problem-solving was his subsequent decision to give his students more time to discuss with other students what they observed in the powder reactions. In this case, relating two events together helped the teacher identify the instructional strategy that generated better student learning outcomes.

Finding #3: Teachers juggle many curricular demands and often have multiple intentions in mind when planning a lesson activity. Instructional intentions sometimes conflict, generating dilemmas in practice. But when teachers work through their dilemmas and succeed, they expand their pedagogical expertise.

Lesson #3: To improve curriculum implementation, help teachers work through their dilemmas. In reflection, a focus on instructional intentions and student actions can aid teachers in managing difficult situations.

Dilemmas complicate teaching tasks and are at times, distressing. It is understandable that teachers may want to avoid such challenging moments. But dilemmas also provide opportunities for teachers to advance their craft, particularly when they are experienced as competing instructional intentions. This was true for Jeff who was trying to teach science content in his classroom discussions and increase the participation of students with special needs. In practice, these intentions conflicted because his familiar style of leading discussions did not teach content in an inclusive classroom. Thus, he developed more sophisticated scaffolding skills to actualize both intentions.

There are two simple strategies that coaches can use to help teachers work through dilemmas. The first is to simply acknowledge that teaching dilemmas exist. They may first surface into teacher awareness as a sense of confusion or frustration. Just being able to articulate and characterize a dilemma can validate teacher experiences. It also externalizes the dilemma into a tangible phenomenon that can be investigated. Assist teachers in determining which instructional intentions drive their lesson plans and call attention to how different

intentions can conflict, leading to problematic situations.

The second strategy involves what to examine with teachers in the reflection. Have teachers provide concrete examples of what happened in a lesson that became dilemmatic and focus on describing actions in the incident. Place emphasis on analyzing student actions and what teacher instructional response followed. This can be achieved with or without the aid of video. In my study, the context was teachers learning to initiate and sustain academic discussions. Thus, student actions were typically what students stated, asked, or contributed in the discussion. Actions also included what students did *not* say nor do that one might expect them to.

Here is why these strategies were helpful. Foremost, dilemmas are not one-time events. They are conflicts that get repeated over time across different teaching situations. Becoming aware of what is dilemmatic can help teachers identify similar situations to which they can apply alternative responses in the future. Thus, understanding one's dilemma can be immensely useful. Furthermore, examining student actions in a particular incident will focus teachers on their craft. The aim is to consider what other strategies can foster better student outcomes after examining student thinking and behavior. Some dilemmas cannot be resolved but many dilemmas can be managed (Lampert, 1985). Strengthening instruction is one way to manage the varied learning objectives that teachers must meet.

Helping teachers reach a conceptual threshold

In my work documenting curriculum implementation, I note that conversations with teachers center on what is working, not working, and how to modify activities. The discourse on uncertainties is not always explicitly stated but remains couched in themes of what is not working. But opening up the discussion to surprises and dilemmas may aid teacher development. This is because uncertainties point to a conceptual threshold, the beginning of a significant shift in teacher understanding (Meyer and Land, 2005).

By being attentive to what is uncertain, we can help teachers arrive.

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